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RAILWAY YARD NOISE

July, 1977



Ontario

Ministry
of the
Environment

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S Y M P O S I U M

ON

RAILWAY CLASSIFICATION YARD NOISE

SPONSORED BY

C.P. RAIL AND ENVIRONMENT ONTARIO

TORONTO

MAY 18, 1977

REPRINTED AUGUST 1979

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ACKNOWLEDGEMENTS

Dr. Gary Faulkner, University of Alberta

C.P. Rail, Eastern Region

Westinghouse Air Brake Company

Toronto Star

INTRODUCTION

This Symposium was structured to bring together all the Canadian experience on the problem of railway noise emissions from classification yards.

The Ministry experience and the relevant literature shows that the most complained about noise sources are those resulting from activities such as humping, locomotive operations and impact noises.

In humping, one or more diesel locomotives coupled together are used to push the cars uphill over the hump. This operation results in idling noise and periodic acceleration noise. On the downward slope of the hump some, or all, of the wheels will react to the braking action of the computer controlled active retarder(s) by generating intense impulsive noise commonly described as wheel screech.

As the individual car, now classified by destination, proceeds along the track it's speed has been adjusted to minimize the impact and impulsive noise caused when it reaches the stationary cars already on that track. Sometimes, however, significant unplanned impacts occur. Finally, when the train on a particular track has been assembled and is removed to the dispatch area, the wheels may again cause noise emissions when passing through the passive retarders.

Other activities in the yard that may cause unacceptable noise emissions would be those from shunting, use of loud speakers and noisy signalling devices. Repair and maintenance activities such as locomotive overhauling and their extended testing under conditions of full rated load may also result in high noise level emissions.

Because a typical yard is in operation around the clock, night time noise emissions are particularly critical.

No attempt was made during the Symposium to arrive at final conclusions or firm recommendations for future courses of action. This report, made up of many parts, speaks eloquently of the need for railway noise control and for noise abatement and also for the need for fundamental acoustic research into special aspects of the railway classification yard noise problem.

It is obviously a problem of serious environmental consequence that must be addressed in the first instance by the Federal Government because under The British North America Act the responsibility for railway operations clearly resides with the central authority. In our view, the remedial action must come from Transport Canada, the Canadian Transport Commission, Environment Canada and the National Research Council. Appropriate support in enforcing applicable land use policies must come, however, from the Province concerned.

A synopsis of the Symposium and the areas for future discussion are adequately contained in the report of an observer to the symposium, Mr. R.F. Boyd, District Officer, Ministry of the Environment, Central Region.

No further comment or observation is therefore offered.

J. Manuel, Supervisor
Noise Pollution Control Section
Pollution Control Planning Branch

July 1977.



Office of the
Minister

Ministry of the
Environment

416/965-1611

135 St. Clair Avenue West
Toronto Ontario
M4V 1P5

INVITATION

CP Rail and the Ministry of the Environment have agreed to co-sponsor a technical symposium on railway classification yard noise problems particularly retarder noise, impact noise and other noises related to operations at the CP Rail Agincourt Yards located in Scarborough Ontario. The symposium will be held in Toronto on May 18, 1977. The purpose of the symposium is to examine the following questions:

- the nature of the noise complaints received
- the resulting noise climate in adjacent residential areas
- current technology
- noise control programs previously attempted elsewhere or currently underway.

It is hope that the pooling of our collective knowledge will assist us in defining the prevailing noise emission mechanisms and indicate future action on abating the various noise problems encountered.

On behalf of both sponsors its gives me great pleasure, therefore, to invite you to attend or have a technical representative attend the symposium. I trust that you will make available to the symposium any information in your possession related to solving this question.

Your early acceptance of this invitation would be appreciated. Your further undertaking to contribute towards the understanding of the nature of the problem would also be appreciated. A list of the proposed participants is attached. For more information on the symposium, please contact Mr. John Manuel, Pollution Control Branch, who has been designated as the co-convenor and program co-ordinator.

LIST OF PARTICIPANTS

Mr. Adolf Andres
Noise Control Engineer
Environment Canada
351 St. Joseph Blvd.
HULL, P.Q.

Mr. S.M. Barluk
Asst. Supt.
C.P. Rail
AGINCOURT, Ontario

Mr. Russell F. Boyd
District Officer, Central Region
MOE Representing Regions/Industrial Abatement
150 Ferrand Drive
DON MILLS, Ontario M3C 3C3

Mr. William Bradley
Consulting Acoustical Engineer
President, Canadian Acoustical Association
3550 Ridgewood Ave.
MONTREAL, Ontario H3V 1C2

Mr. Tony Embleton
Principal Research Officer
National Research Council
Montreal Road
OTTAWA, Ontario K1A 0S1

Mr. Gary Faulkner
Associate Professor
University of Alberta
Department of Mechanical Engineering
EDMONTON, Alberta T6G 2G8

Dr. William Griggs
Director, Resources and Environment
Urban Affairs
Montreal Road, CMHC Annex
Room 65
OTTAWA, Ontario

Mr. R.E. Halliwell
National Research Council
Division of Building Research
OTTAWA, Ontario

Mr. E.J. Hase
Director - Safety and Standards, RTC
Canadian Transport Commission
275 Slater St.
OTTAWA, Ontario K1A 0N9

Mr. Ashley G. Hibbard
Director, Rail Service Branch
Canadian Transport Commission
275 Slater St.
OTTAWA, Ontario K1A 0N9

Mr. Peter Hoisak
Chief, Railway Capacity Development
Transport Canada
27th Floor, Tower 'C', Place de Ville
OTTAWA, Ontario K1A 0N5

Mr. G. Krishnappa
Associate Research Officer
Mechanical Engineering Division, M-7
National Research Council
Montreal Road,
OTTAWA, Ontario K1A 0R6

Mr. E.C.B. MacNabb
Manager of Development
C.P. Rail
Room 354
Union Station
TORONTO, Ontario

Mr. Douglas McFarlane
Manager, Environmental Office
Ministry of Transportation and Communications
1201 Wilson Ave.
DOWNSVIEW, Ontario M3M 1J8

Mr. Peter Noble
Senior Mechanical Engineer
WABCO Union Switch - Signal Division
PITTSBURGH, Pennsylvania 15218

Mr. M. Osman
Research Officer
Ministry of Transportation and Communications
1201 Wilson Ave.
DOWNSVIEW, Ontario M3M 1J8

Mr. A.R. Schmidt
Policy Advisor (Transportation)
TEIGA
Economic Analysis Branch, Room 332
Frost Bldg. North
Queen's Park
TORONTO, Ontario M7A 1Y7

Mr. E.J. Sexton
Product Engineer
General Railway Signal Co.
P.O. Box 600
ROCHESTER, N.Y. 14602

Mr. Victor Shantora
Head, Environmental Engineering Section
Department of Fisheries and Environment
Environmental Protection Service, Ontario Region
135 St. Clair Ave. West, 2nd Floor
TORONTO, Ontario M4V 1P5

Mr. J.S. Smith
Deputy Chief Engineer
C.P. Rail
Room 401, Windsor Station
MONTREAL, P.Q. H3C 2H8

Mr. A.L. Walton
Project Co-ordinator
Central Mortgage and Housing Corp.
National Office
Montreal Road
OTTAWA, Ontario

Mr. Alexander Wilson
Manager, Proposals and Contracts
Union Switch and Signal Division of WABCO
1789 Braddock Ave.
PITTBURGH, Pa. 15235

SYNOPSIS

Report on Symposium-Railway Classification
Yard Noise Sponsored by CP Rail and
Ontario Ministry of the Environment on
May 18, 1977 in Toronto

This symposium which I attended on behalf of the Ministry of the Environment Regional Offices was chaired by Mr. John Manuel, Supervisor, Noise Pollution Control Section. The objective of this essentially technical meeting was to provide ideas for direction and strategy in dealing with the railway classification noise problem. Attendance was restricted by invitation only. A more detailed report and a list of the participants are to be provided by the Noise Section.

The main ideas for action gleaned from the presentations and discussions can be summarized as follows:

There are no immediate practical solutions to classification yard noise problems but they can eventually be alleviated through the cooperative effort of all levels of government and the railways working toward longer term solutions. Such efforts should be directed toward the following:

1. Noise and sociological studies to determine the zones of adverse impact of present yard operations and to establish acceptable noise limits indoor and outdoor in the vicinity of these operations.
2. Federal government and railway funded research into the retarder noise problem and its solution. This should take full advantage of any such research conducted elsewhere and of the natural incentive for the suppliers of the retarder equipment to solve this problem.
3. Closer cooperation between the federal, provincial and local government with regard to control of land use in the vicinity of railway classification yards. This effort could run parallel to that applied in recent years with regard to landuse in the vicinity of some airports.
4. The development of building code specifications for adequate noise insulation in buildings to be located in the designated noise zones near classification yards. These specifications should be embodied in the guidelines for approval of land development by municipal and provincial authorities.

5. The Federal Government should be encouraged by MOE and all other interested parties to play the leading role with respect to the above areas for cooperative action. Only they, having exclusive jurisdiction over the Regulation of Railways can play this role effectively.

It was proposed to reconvene this symposium in three to six months to note any significant actions taken and to exchange further ideas.

(This is a facsimile of an internal report prepared by Mr. R.F. Boyd, District Officer, MOE)



Minister of the
Environment

416/965-1611

135 St. Clair Avenue West
Toronto Ontario
M4V 1P5

September 7, 1976.

Mr. F.S. Burbridge, President
C.P. Rail
Room 215
Windsor Station
MONTREAL, P.Q. H3C 3C4

Dear Mr. Burbridge:

The Ontario Ministry of the Environment continues to receive complaints from residents of the Borough of Scarborough regarding noise emissions from the C.P. Rail, Agincourt marshalling yard. You are aware, I am sure, of the many public protests on this matter.

In response to a request for assistance from Alderman John Winbs of the Corporation of the Borough of Scarborough, I have indicated that I am in sympathy with the Scarborough residents presently being impacted by excessive noise from the yard. A copy of my letter to Alderman Winbs is attached for your information and action. I am also advising the federal government authorities of my concern.

It appears that there is a need for a public commitment by your Company that definitive steps will be taken to abate the noise nuisance. I am prepared to have my technical staff assist, on a consulting basis, in defining the noise problem and to consider practical solutions. I might add that under the Provincial legislation, The Environmental Protection Act, 1971, sound and vibration are both defined as contaminants and emissions causing material discomfort are prohibited.

Your comment and intentions with regard to this specific problem are invited.

Sincerely,

ORIGINAL SIGNED BY
HON. GEORGE A. KERR, Q.C.

George A. Kerr
Minister

Encl.

cc: Hon. Romeo Le Blanc
Acting Minister, Environment Canada
Hon. E.J. Benson, President
Canadian Transport Commission



Minister of the
Environment

416/965-1611

135 St. Clair Avenue West

Toronto Ontario

M4V 1P5

September 7, 1976

Mr. John Wixbs
Alderman, Ward II
The Corporation of the Borough of Scarborough
150 Borough Drive
SCARBOROUGH, Ontario M1P 4N7

Dear Mr. Wixbs:

RE: Agincourt Marshalling Yards, CPR

Your letter regarding the noise problem from the Agincourt marshalling yards is acknowledged. This matter is of great concern to myself and this Ministry but because of the problem of jurisdiction, however, there does not seem to be much I can do at this time except offer moral support. The responsibility for noise control and abatement clearly lies with the federal government under the legislation.

I am prepared, however, to have my staff look at your file on the subject matter on the clear understanding that this Ministry is doing so for information purposes only. I am aware of the very large number of people in Scarborough who are constantly being exposed to noise from the Agincourt marshalling yard and this state of affairs has influenced my decision to accept your file for study.

By copy of this letter I am advising the federal authorities of my concerns and my interest in protecting the citizens of Scarborough from unnecessarily high noise levels from the Agincourt marshalling yards.

Sincerely,

Original signed by
HON. GEORGE A. KERR, Q.C.
George A. Kerr
Minister

CP Rail

Keith Campbell
Vice President, CP Rail

Windsor, Ontario
1000 Lakeshore Blvd. West
Toronto, Ontario M8Z 1A1



Montreal, October 7, 1976

File: 2734-18

The Hon. George A. Kerr, Q.C.
Minister
The Ontario Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario

Dear Mr. Kerr:

Your letter of September 7, 1976 addressed to the President in respect of CP Rail's Agincourt Marshalling Yard has been reviewed and I shall attempt to give you a concise summary of the situation as it is known to us. As you suggest, we are aware of the situation having dealt with Federal Government Agencies, the Borough of Scarborough and individual citizens. CP Rail would certainly welcome your constructive assistance to determine practical solutions to the problems that people appear to be experiencing.

Some thirty years ago CP Rail, after thoroughly reviewing its Toronto operations, decided to establish a major classification yard at Agincourt and transfer a great part of the workload away from the densely built-up areas in the City of Toronto. At that time the new yard area under consideration was entirely rural in character and the municipality approved the proposed industrial land use by CP Rail when detailed planning got under way in the mid 1950's. The yard became operational in 1964 after an expenditure up to that time of over \$15 million and a reorganization of marshalling procedures having implications on rail operations as far away as Montreal, Windsor and Winnipeg. In short, the Agincourt facility is the most intensively used marshalling yard throughout CP Rail, located as it is in the industrial heartland of Canada.

.../2

Regrettably, over the years those in control of adjacent land sought and secured changes in zoning from industrial to housing with the sanction of municipal authorities and those who sit in judgment of the official plan of the municipality. The railway did not seek the changes and has consistently raised objections to such changes when there was an opportunity to do so. The railway, by choice, would prefer industry located next to it as this presents greater opportunity to serve industry and the transportation needs of our Country in the most economical way.

The marshalling activity in the yards has not changed in character since construction but the perception of noise has increased proportionately by those who have chosen to dwell ever closer to the facilities.

Railway classification yards world-over have similar characteristics and methods to control the generation of noise and its attenuation has been studied assiduously by many authorities. Through rail related investigations in United States and Canada there has been a better understanding achieved of the basic causes of noise generation but unfortunately no sure cure has emerged. CP tested water sprays at Agincourt some years ago but the results were not at all encouraging. Before really meaningful results can be achieved much more research and testing will have to be carried out at very considerable expense. The Association of American Railways, individual railways and equipment suppliers of classification yard facilities are all concerned in this problem which is unlikely to yield to simplistic solutions. Any help that your Ministry could furnish would be most welcome indeed.

CP Rail is aware of its responsibilities in being a good neighbour to those who elect to live nearby and will continue its search for solutions that may well be extremely costly so that nearby homeowners will enjoy a better quality of life and at the same time gain a tax-free enhancement of property value.

.../3

You may be sure that we are doing what we can to mitigate the problem and regret that our neighbours will be inconvenienced while the search for solutions goes on and we are, of necessity, obliged to continue to carry on with the production of essential transportation serving the trade and commerce of this Nation.

Yours truly,

A handwritten signature in dark ink, appearing to read "L. B. Nichols", written in a cursive style.



Minister of the
Environment

416/965-1611

135 St. Clair Avenue West
Toronto Ontario
M4V 1P5

February 21, 1977.

Mr. Keith Campbell
Senior Executive Officer
CP Rail
Windsor Station
MONTREAL, Quebec H3C 3E4

Dear Mr. Campbell:

I refer to my earlier letter of September 7, 1976 and your response in respect to the operations of CP Rail's Agincourt Marshalling Yard. Your statement that CP Rail would welcome constructive assistance to determine practical solutions to the noise problem at your Agincourt Yard is acknowledged. Your summary of the situation with regard to noise perception and noise generation was useful because it confirmed our own experience in responding to noise complaints from the citizens adjacent to the yard.

It is regrettable that the potential noise impacts were not more carefully considered and taken into account when detailed planning got under way at Agincourt during the mid-1950's. Your contention that the local municipal authority and the Ontario Municipal Board should have provided a buffer in Agincourt by freezing land around the Yard is to be balanced against the urgent need to provide land for housing in the area. It can also be argued that CP Rail had an obligation to provide an adequate noise buffer around the Yard by acquiring the necessary land during the land assembly.

Hindsight, however, is not now going to solve this noise problem, or still the many complaints from residents living in adjacent subdivisions. I propose, therefore, that as a first step, a noise symposium be convened under our joint auspices to examine the problem of railway yard classification noise and the state of the art. I hope that out of this

...2

symposium a working group will be established that can liaise with CP Rail in trying to abate the noise problem in Agincourt. I attach for your consideration a list of participants that we mutually might consider inviting to such a proposed symposium.

Should you agree that this proposed course of action is desirable; please have your representatives contact Mr. John Manuel, Supervisor, Noise Pollution Control Section, Pollution Control Branch of this Ministry at the earliest opportunity so that they both might proceed with plans for convening such a symposium.

Sincerely,

original signed by
HON. GEORGE A. KERR, Q.C.

George A. Kerr
Minister

Encl.

cc: The Hon. E.J. Benson
President
Canadian Transport Commission

CP Rail

Wincham Station, Montreal, Quebec, Canada
Tel (514) 381-1811 Telex 960 6874

MONTREAL, February 28, 1977

File: 2734-18

The Hon. George A. Kerr, Q.C.
Minister of the Environment
The Ontario Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario

Dear Sir:

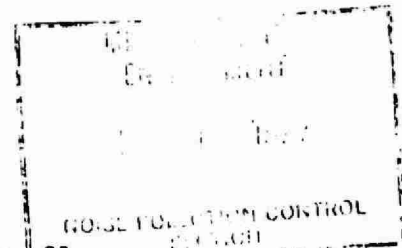
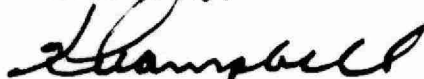
This has reference to your letter of February 21 suggesting a symposium on railway classification yard noise that might be convened arising from the issue at CP Rail's Agincourt Yard.

CP Rail would be pleased to co-sponsor and attend a private gathering and would be prepared to make available information and facts surrounding this problem as it is known to the railway. Our preference would be for participation as indicated in your letter. Those attending should be qualified to contribute toward the solution and with a capability of understanding the problem. The difficulties, of course, are not limited to Agincourt and we feel they are of national importance. Our delegate therefore, would be from the Chief Engineer's Office of CP Rail, Montreal, together with observers from CP Rail, Toronto, people familiar with the locale of Agincourt.

For this initial meeting CP Rail people would set aside the whole day which should be sufficient time to establish procedures for any further agreed upon studies or investigations.

The proposed date of April 27 is satisfactory and our people are arranging to get in touch with your Mr. John Manuel to confirm any further details. There is no objection to your issuing invitations to attend over our joint sponsorship for this meeting.

Yours truly,



CP Rail

Eastern Region Union Station, Toronto, Ontario M5J 1E8
Tel (416) 366 2411

R. S. ALLISON
Vice President

L. A. HILL
General Manager
Operation and Maintenance

J. A. TEOLI
General Manager
Marketing and Sales

G. DOW
Administrative Assistant
Vice President

July 7, 1977

File - 21221

Mr. J. Manuel, Supervisor
Noise Pollution Control Section
Ministry of the Environment
135 St. Clair Avenue West
Suite 100
Toronto, Ontario
M4V 1P5

Dear Sir:

I have your letter of June 24, 1977 in respect of the Railway Classification Yard Noise Symposium held May 18, 1977. I thank you for the printed remarks which accompanied your letter and read them over with interest. At this time CP Rail will not be making an official statement since our position in the matter has already been well documented.

I do note however that the May 9, 1977 issue of Railway Age contains a reference to a modified retarder brake shoe said to emit less humping screech when in use. It is well to know that developments are proceeding in other parts of the world which may be of advantage to us here in the future.

Yours truly


E.C.B. Macnabb
Manager Development





Minister
Transport Canada

Ministre
Transports Canada

MAY 27 1977

The Honourable George A. Kerr,
Minister of the Environment,
Province of Ontario,
135 St. Clair Avenue West,
Toronto, Ontario.
M4V 1P5



Dear Mr. Kerr:

Thank you for your letter of April 20, 1977, extending an invitation to attend the Symposium on Railway Noise in Toronto on May 18, 1977. Regretfully, I was not able to attend, but arrangements were made for an official from the Railway Transportation Directorate to represent my Department.

I see this Symposium as a worthwhile step in dealing with the complex question of railway noise in urban areas and, to this end, your Department can count on Transport Canada's cooperation and assistance.

Yours sincerely,


Otto Lang

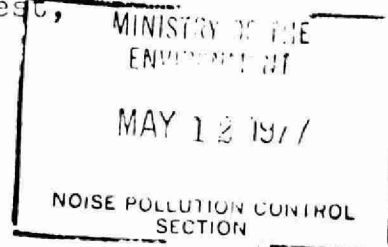


Canadian TRANSPORT
Commission

Commission canadienne
des TRANSPORTS

OTTAWA, April 29, 1977
K1A 0N9.

Mr. George Kerr,
Minister of the Environment,
Ontario,
135 St. Clair Avenue West,
TORONTO, Ontario.
M4V 1P5.



Dear Mr. Kerr:

Thank you for your letter of April 20, 1977 inviting the Commission to participate in the forthcoming symposium on railway classification yard noise co-sponsored by the Ministry of the Environment and CP Rail.

Your thoughtfulness in affording the Commission to be represented is greatly appreciated and it gives me great pleasure to accept the invitation. I am arranging for two technical officers to attend and you may be assured of our fullest co-operation in seeking an understanding of the problem.

Mr. E.J. Hase, Director, Safety and Standards Branch will contact Mr. Manuel at an early date to advise him of the names of the Commission representatives.

Yours truly,

E.J. Benson,
President.



Secretary of the Ministry of State
Urban Affairs Canada

Secrétaire du Ministère d'État
Affaires urbaines Canada

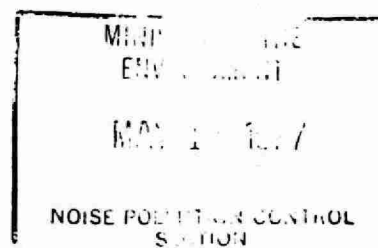
Chairman of the Board
of Central Mortgage and Housing
Corporation

Président du conseil d'administration
de la Société centrale d'hypothèques
et de logement

May 9, 1977.



The Honourable George A. Kerr,
Minister of Environment,
135 St. Clair Avenue West,
14th floor,
Toronto, Ontario.
M4V 1P5



Dear Mr. Kerr:

Thank you for your letter of April 20 in which you invited me to participate in a Symposium on noise to be held in Toronto on May 18, 1977.

As Chairman of Central Mortgage and Housing Corporation and as Secretary of the Ministry of State for Urban Affairs, I am pleased to report that both agencies are taking an active interest in noise-related matters. With respect to activities of the Corporation, my staff are in the process of developing residential property standards to minimize the effects of road and rail noise. Officials within the Ministry of State for Urban Affairs are becoming increasingly concerned with the effects that various pollutants have upon the quality of life in Canadian cities, and one area which is receiving attention is noise pollution. Any occasion, therefore, which focusses upon urban pollution issues is welcomed by both the Corporation as well as the Ministry.

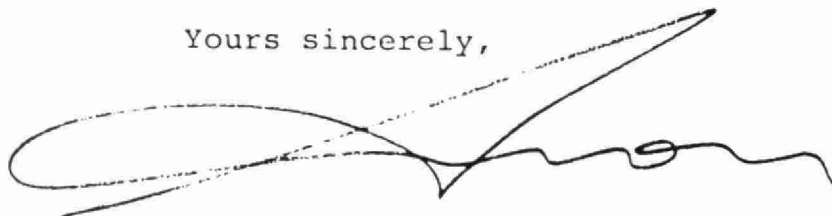
Due to previous commitments, I regret that I will be unable to attend the Symposium. However, I would like to suggest that Mr. A.L. Walton of the Professional Standards and Technology, CMHC, and Dr. William Griggs, Director of the Natural Environment and Resources, MSUA, attend the Symposium on my behalf. Both these persons are familiar

.../2

with the major issues involving noise and railway activities, especially in Southern Ontario, and I believe they will contribute towards discussions at the Symposium.

May I take this opportunity to wish you every success in hosting this Symposium.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'William Teron', with a large, sweeping loop at the beginning and a long, horizontal flourish extending to the right.

William Teron,
Secretary.



National Research Council
Canada

Conseil national de recherches
Canada

President

Président



April 27, 1977

Mr. G.A. Kerr,
Minister of the Environment,
135 St. Clair Ave. W.,
Toronto,
Ontario M4V 1P5

Dear Mr. Kerr,

Thank you for your invitation to attend the technical symposium concerned with railway yard noise that your Ministry is organizing on May 18th.

The Acoustics Section of our Division of Physics has been concerned with noise problems for many years. Dr. T.F.W. Embleton of the Acoustics Section would be pleased to attend your symposium and to make available to you any relevant information that we possess.

Would you please arrange that information on the symposium be sent directly to:

Dr. T.F.W. Embleton,
Acoustics Section,
Division of Physics,
National Research Council of Canada,
Ottawa, Ontario K1A 0R6

Yours very sincerely,

W.G. SCHNEIDER



Environment
Canada

Environnement
Canada

Environmental
Protection

Protection de
l'Environnement

Ottawa, Ontario.

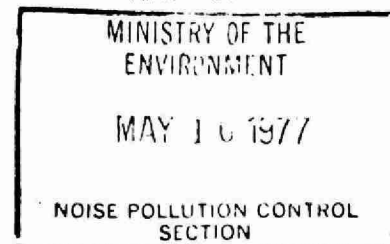
K1A 1C8

MAY 13 1977

Vous l'avez *Votre référence*

Objet *Notre référence*

Mr. John Manuel,
Supervisor,
Noise Pollution Control Section,
Ontario Ministry of the Environment,
135 St. Clair Avenue West,
Toronto, Ontario.
M4V 1P5



Dear Mr. Manuel:

I have been asked by the Honourable Roméo LeBlanc to reply to the Honourable George Kerr's April 20, 1977 letter requesting his or a technical representative's participation in the May 18, 1977 Symposium on Railway Noise.

Mr. Kerr's invitation is very much appreciated. I am pleased to inform you that Mr. Adolf Andres and Mr. Vic Shantora will attend this Symposium. I expect that our contribution will be useful and that further cooperation in this and other areas will lead to satisfactory solutions of the railway noise problem.

Yours sincerely,

L. Edgeworth
Assistant Deputy Minister



Office of the
Treasurer
Ontario

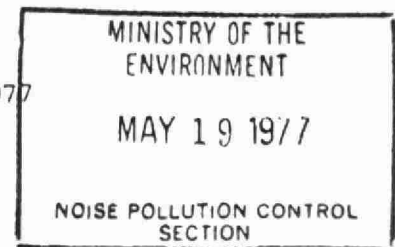
Ministry of Treasury
Economics and
Intergovernmental
Affairs

416/965-6361

Frost Building
Queen's Park
Toronto Ontario



May 9, 1977



Dear George -

I am interested in having one of my people attend your symposium on May 18 concerning the problems of noise from railway classification yards and possible abatement measures. While the railways must be encouraged to continue performing their vital transportation functions in an effective and efficient manner, their activities should be consistent with their reasonable obligations as neighbours in the urban environment.

I thank you for the invitation in your letter dated April 20. My representative, Mr. A.R. Schmidt from the Economic Analysis Branch, will be getting in touch with Mr. Manuel concerning the details.

Yours sincerely,

W. Darcy McKeough
Treasurer of Ontario

The Honourable George A. Kerr, Q.C.
Minister of the Environment
14th Floor
135 St. Clair Avenue West
Toronto, Ontario



Office of the
Minister

Ministry of
Transportation &
Communications

416/965-2101

Ferguson Block
Queen's Park
Toronto Ontario



May 6, 1977

Honourable George A. Kerr,
Minister of the Environment,
135 St. Clair Avenue West,
Toronto, Ontario.



Dear George:

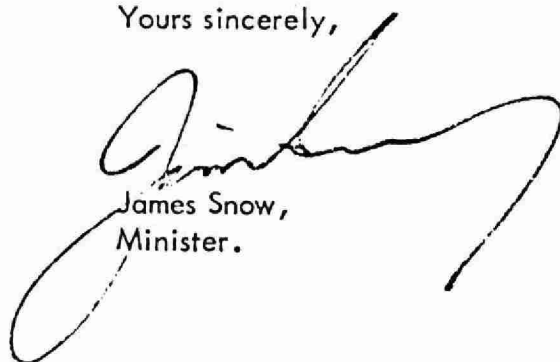
Thank you for the invitation to attend the technical symposium
on railway classification yard noise on May 18th, 1977.

This is certainly an important public issue and I appreciate the
efforts of your Ministry and C.P. Rail in co-sponsoring the
symposium.

I have asked Mr. Douglas McFarlane, Manager of the Ministry's
Environmental Office to represent the Ministry at this meeting.

With kindest regards, I remain

Yours sincerely,



James Snow,
Minister.

The Canadian Acoustical Association
l'Association Canadienne de l'Acoustique



2 May 77

Mr. George A. Kerr
Minister
Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ont.
M4V 1P5



Dear Mr. Kerr:

Thank you very much for the kind invitation to the technical symposium on railway classification yard noise. Unfortunately, the timing is such that I will be on vacation.

I have taken the liberty of asking Dr. C.W. Bradley, the president of the Canadian Acoustical Committee, to take my place. I trust this meets with your approval.

Yours truly,

Cameron W. Sherry, Eng.
Secretary -
Canadian Acoustical Association

cc. C.W. Bradley

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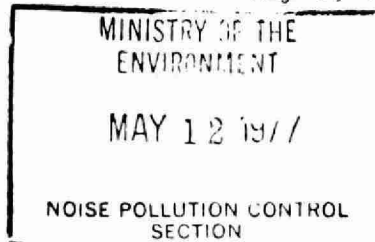
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May 6, 1977



Dear Mr. Kerr:

On behalf of the President, I acknowledge your letter of April 20 inviting Canadian National representation to a symposium on railway classification yard noise problems being held in Toronto on May 18.

I am very sorry to advise that the President is unable to accept your invitation, nor will there be representation from CN Rail on this occasion.

It is to be hoped that discussions arising from the symposium will produce beneficial results in the combating of noise pollution.

Yours sincerely,

Administrative Officer

The Honourable George A. Kerr,
Minister of the Environment,
135 St. Clair Avenue West,
Toronto, Ont. M4V 1P5

SYMPOSIUM ON RAILWAY
CLASSIFICATION YARD NOISE

DATE: May 18, 1977

PLACE: MACDONALD BLOCK, NIPIGON ROOM
900 Bay St, Queen's Park
Toronto

TIME: 10:00 a.m.

LIST OF PARTICIPANTS

C.P. Rail

Suppliers/Consultants (CP Rail)

Environment Ontario

C.N. Rail

(Declined)

Canadian Transport Commission

Canadian Acoustical Association

Environment Canada

National Research Council

Central Mortgage and Housing Corp.

Transport Canada

Transport Ontario

Housing Ontario

(Did not attend)

University of Alberta

SYMPOSIUM

Railway Classification Yard Noise

Sponsored By

C.P. Rail and the Ministry of the Environment

Toronto - May 18, 1977

A G E N D A

- 10:00 Welcome to participants
- 10:35 Position Paper by Department of Environment
- 10:50 Presentation by Dr. Gary Faulkner
University of Alberta, Edmonton
- 12:00 Presentation by Abatement and Land Assessment Unit,
Pollution Control Branch, Environment Ontario
-Subdivision assessment
-Outline of noise investigation

L U N C H

- 14:00 Discussion
- 16:00 Symposium Ends

RAILWAY CLASSIFICATION YARD NOISE SYMPOSIUM

Opening Statement By Mr. Manuel:

The Symposium probably came about as a result of an accumulation of complaints received by the Ministry of the Environment from a number of sources regarding hump yard noise. Complainants are all citizens living in the Borough of Scarborough. These particular complaints were lodged by telephone with the Noise Pollution Control Section and with the Central Regional Office and in letters from residents living in the vicinity of the CP Rail Agincourt Marshalling Yard. From copies of correspondence in Ministry files, it is obvious that complaints have also been directed to incumbent members of parliament, members of the provincial legislature of Ontario, Ministers of the Crown at both the federal and provincial level, various Ministeries as well as various regulatory agencies.

The decision to make an initial high level approach to CP Rail on this problem probably came as a result of a request to the Minister of the Environment, the Honourable George A. Kerr, from the Borough of Scarborough. The Minister was asked to accept a dossier of noise complaints for study that had accumulated concerning this particular problem. The Minister agreed to have his staff study the documents with a clear understanding that they be accepted for information only. Acceptance of the dossier would not commit the Ministry of the Environment or the Government of Ontario to any specific course of action until the technical problems and ramifications of these noise complaints were understood and evaluated. It was hoped, of course, that this Symposium would lead towards a better understanding of the noise problems that have surfaced in all the accumulated correspondence.

When staff of the Ministry started to talk to CP Rail about the problem it was clear that although the Noise Pollution Control Section of the Ministry was primarily interested in the Scarborough hump yard problem there are many other railway yards causing the same noise emission problem. Therefore, it is not only a problem in the Borough of Scarborough, it is a problem across Ontario, across Canada and Internationally. What we are doing today is simply looking at the broad picture to consider what can be done to abate all types of marshalling yard noises however they may occur.

Once the decision was made to officially advise CP Rail of our concerns, it was thought that perhaps the best way to get a grip on the problem was for CP Rail and the Ministry of the Environment initially to co-sponsor a Symposium on railway classification yard noise. Of course, we in the Ministry were delighted when we received a positive response from CP Rail to this proposal. CP Rail agreed that they would be prepared to join with us in sponsoring this symposium and after some preliminary conversations concerning the scope of the Symposium and the intentions of the Ministry the present format was agreed to. It was stressed that our objective should be purely fact finding. There is a noise problem and we are trying to find out what the nature of the problem is and what we possibly can do towards assisting in solving it.

On the basis of that initial exchange it was also agreed that it would be a good idea to hold the Symposium and invite representatives who might conceivably be interested in attending this technical discussion. I am delighted, of course, that there has been this response. Perhaps, because of this meeting today, we will have a direction or goal for future research.

Although the problem of noise emissions from the particular yard in Scarborough prompted this Symposium, we recognize that the particular acoustical mechanisms involved are complex and for that reason I particularly want to welcome representatives from three Branches of the National Research Council of Canada who are, I trust, going to supply a lot of the brain power toward solving some of these problems. I would like to also welcome Dr. Bill Bradley representing the Canadian Acoustical Association, a scientific and technical group that probably represents the main force we have at our disposal in understanding the nature of the acoustics involved here.

Perhaps later on in the day we may get Mr. MacNabb of CP Rail to say a few words about how the Scarborough yard site was located. By putting the classification yard in farm land far away from the City centre it seemed that there would be no problem with respect to noise. Over the years, however, this yard has grown and at the same time the local municipality in its wisdom has chosen to develop the surrounding areas. From experience, we know that local councils and local politicians are pressured by developers to develop lands that could generally be considered unsuitable for residential development, so we can understand the pressures that might have caused the Scarborough Council to permit residential development on adjacent lands. Unfortunately, the situation today is that in parts of the surrounding land area, development has pretty well come up to the property line of the CP Yard. Now this in itself is not bad, if certain noise limitations were understood. For example, that there would occasionally be a noise problem experienced by people enjoying the outdoors.

I have been told that on occasion people living more than a mile away from the Yard claim that they can hear the retarder screech. When Ministry staff recently visited the yard, there were cars being humped and on that day for various reasons, only a few of the wheels squealed or screeched. The rest passed through the retarder without any problem and no untoward noise was generated. So it is obviously not a constant problem. The reason for these variations is one of the many problems we will have to explore.

Let me say a few words about the legislation. The Ontario Ministry of the Environment, has a specific responsibility under The Environmental Protection Act and other legislation in Ontario particularly The Environmental Assessment Act. The other legislation that we work with is The Planning Act. This is an Act which is administered by the Minister of Housing and one of our functions in this Ministry is to provide comment to the Ministry of Housing on all land use proposals with respect to noise. This noise comment activity was rigorously instituted as of January, 1975. As you are aware a plan of subdivision may take several years to mature. It is quite possible, therefore, that there are subdivisions presently being constructed in the vicinity of the Scarborough Yard that were approved before January, 1975 and consequently will have escaped our close scrutiny.

I should also mention the regulatory aspect of the Ministry's role. We recognize that railways are essentially controlled at the federal level of government through the Canadian Transport Commission. However, there have been cases where provincial authorities have been able to intervene at the local level in respect to environmental concerns. There is always a possibility that noise, defined under The Environmental Act as a contaminant, may afford grounds for future provincial regulation of certain railway activities. It is also possible that there could be some independent action contemplated in the future by citizens of this Province who may initiate proceedings under The Environmental Act, or more interestingly seek civil remedies.

A case that is now before the Courts concerns a citizen in Niagara Falls, Ontario, who has chosen not to use the Act to prosecute a polluter of the environment with respect to noise but has simply sued for damages. We in the Ministry are involved in the case because we made the original assessment of the noise problem. The complainant is attempting to use our findings and standards to extract damages from the polluter. So there obviously will be situations where the public can be involved independently in legal actions against noise polluters, whoever they may be, with this Ministry acting as their technical resource.

There is evidence today of an increasing public awareness about noise. This is true in the United States and it is certainly true in Ontario. In Ontario, we are becoming more and more aware of the public involvement. There are environmental groups springing up and there is an organized environmental lobby. When I say organized, I should point out that when the government recently attempted to pass The Environmental Assessment Act, the lobbying was so strong that the government was forced to change significant parts of the Act. Public awareness is a very strong and important force that we should recognize. It is primarily for this reason that we chose to look at the problem today on a technical level so that the public can be provided with a realistic prognosis as well as assurances that recognition of the noise problem in railway classification yards has reached responsible levels of government.



Environment
Canada

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Protection de
l'Environnement

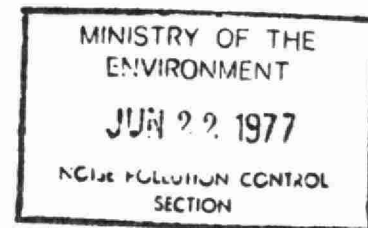
Ottawa, Ontario.
K1A 1C8

June 20, 1977

Reçu de - Votre référence

Copie de - Votre référence

Mr. J. Manuel,
Supervisor,
Noise Pollution Control Section,
Ministry of the Environment,
135 St. Clair Avenue West,
Suite 100,
Toronto, Ontario.
M4V 1P5



Dear Mr. Manuel:

I have made certain changes to the draft of my presentation to the symposium on Railway Classification Yard Noise for reasons of clarity.

I would like to take the opportunity at this time to thank you for inviting us to this seminar. This symposium was very useful since it reinforced my convictions that only strong federal and provincial control will result in the alleviation of railway and other environmental noise problems.

Yours truly,

A. Andres,
Noise Control Engineer.

Encl.

Position Paper by:

Mr. Adolf Andres - Department of the Environment, Ottawa

I think I am going to mention a few things that you have already mentioned, Mr. Chairman.

I would like to give an overview of the railway noise problem as we see it in Environment Canada and try to give kind of a perspective of the problem as we see it.

We have estimated that approximately 500,000 Canadians live where railway noise is excessive and as Mr. John Manuel has said many people have complained to all levels of government and to the railways so this gives us an indication why so many complaints have been expressed by people; because so many people are exposed to the noise. Not only have people complained but they have also formed into citizens' action groups which have exerted pressure to reduce noise levels along various railways and other facilities, to prevent proposed expansion and also they have, in certain cases, wanted certain facilities to relocate to other areas. Citizens' action groups have also delayed and caused the relocation of proposed railway projects. So we can tell that there are some economics involved not only with regard to noise reduction but also the economics which are involved in delaying projects or relocating them. Therefore, whenever we talk about noise reduction we have to consider both costs. Now, people are becoming more concerned about the quality of their life and we can expect that there will be more citizens' action groups creating a greater economic impact.

The railways and the municipalities have a primary and, in essence, a joint responsibility for minimizing the impact of railway noise on the public. The railways can reduce the noise levels of their equipment and the municipalities can do proper land use planning. More specifically, the railways have the responsibility to purchase quieter railway equipment, locate rail lines and yards where the noise impact will be minimal and modify operational procedures and yard and line configurations as necessary and take other steps.

The municipalities have a responsibility to implement land use planning which would prevent encroachment of residences on noise impacted land, develop long range rezoning plans that will remove residences from noise impacted lands, and implement strict building codes which require adequate sound insulation, proper orientation of buildings with respect to noise sources and take other action.

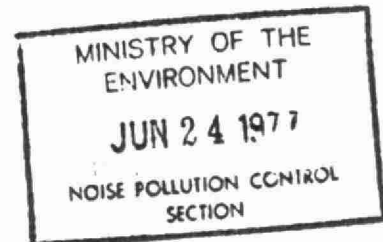
According to The British North America Act of 1867 the Federal Government has exclusive jurisdiction over interprovincial and international railways. The definition of railways in The Railway Act includes all rolling stock and equipment owned by the railway. Therefore the Federal Government has a major noise control function to perform to ensure that the railways reduce the noise emissions to whatever levels are appropriate. The BNA Act of 1867 also give exclusive powers to the provinces for anything that is of a private nature which would include land use planning, building codes etc. Therefore we see that the provinces also have a major noise control responsibility - to ensure that the municipalities initiate proper land use planning and as Mr. John Manuel has said, Ontario is already involved in that to a certain degree. They are reviewing various types of projects to ensure that they will comply and that residential building is not allowed too close to railways or other noisy places. Most other provinces have done very little in this area. There is a problem in that certain provinces have handed over some of their control functions to certain municipalities; Winnipeg is a good example, but The BNA Act still makes the province responsible. In some of these cases, I think the only thing that can be done is for the provinces to take back some of their powers. It may be a little difficult but there has to be some type of control over the municipalities.

I don't know if these points I have just mentioned have been too clear, but what I am trying to say is that the railways and municipalities can only directly do something about the problems whereas the Federal Government can provide controls to ensure that something is done by the railways and the provincial government can provide controls to ensure that the municipalities do what they are supposed to do.

There are various things which can be done at the Agincourt Yards in Scarborough, Ontario to reduce noise levels. I don't think that I will get into that in detail because I think many people will talk about that. I would like to tell you a few things about what we feel should be done with regard to railway problems. First of all, it appears to us that what is required is to prepare noise contours such as L_{eq} or L_{dn} around major yards or major lines such as has been done around airports and then to choose acceptable noise limits. This undoubtedly will be difficult. After this we can see what has to be done by the railways is to constrict these noise contours; what has to be done to reduce noise levels to ensure that the contours will move inwards so that any residences which are now in noise impacted areas will essentially be outside of the unacceptable noise levels. Last of all, a combined effort is really going to be required to prevent residential development within unacceptable noise contours. If certain residential developments are constructed within unacceptable contours, then it is necessary to have buildings which are properly situated, insulated, etc. The important thing is that there is an acceptable noise environment both indoors and outdoors. I think that this is something we can discuss later on but I do feel that the preparation of noise contours is going to be an important thing because right now the municipalities don't know how close to build to the railways. The railways say "don't build too close it is too noisy," and the municipalities say "well, no, it is not too noisy we can build closer". If we do have contours and make a decision as to what maximum noise levels residences can encroach upon, we will have taken the first most important step in search of solutions to the railway noise problem.



June 22, 1977.



Mr. J. Manuel, Supervisor
Noise Pollution Control Section,
Ministry of the Environment,
135 St. Clair Avenue West,
Suite 100,
Toronto, Ontario. M4V 1P5

Dear John,

Enclosed is the original of a revised version of my talk from the Rail Noise Symposium of May 18, 1977. I have tried to stay with the original themes but changed the wording to what I thought I said or perhaps should have said. The presentation makes reference to the paper I sent you earlier with the intention that it be included with the enclosed presentation.

I hope that this is in a form suitable to you. If not please let me know.

Yours truly,

A handwritten signature in cursive script, appearing to read "Gary".

Gary Faulkner,
Associate Professor,
MECHANICAL ENGINEERING.

GF:hw
enclosure

Presentation By
Dr. Gary Faulkner
Department of Mechanical Engineering
University of Alberta

I would like to spend some time talking about the noise situation around the CN Yards in Edmonton, some of the control measures which have been attempted and some of the other measures which have been tried elsewhere. I hope that some of the gentlemen from equipment suppliers such as WABCO can add to my discussion as I am certainly no expert on all of this equipment. I would then like to go on and talk a little bit about the work which we are currently doing concerning retarder noise. This should include some ideas of how we can control this particular form of noise.

The Calder Yards in Edmonton were built a number of years ago, however, in about 1971 a hump yard was built within these facilities. (A general view of the area is shown in Figure 1). Starting in late 1971 or in 1972 there were complaints about the yard from the residential area to the north of it. While the yards were initially constructed without any residential areas around it, as is the usual case residential areas have encroached so that at the present time there are homes right up to 127 Avenue which is also the boundary of the CN property. To the south of the yard we have 125 Avenue which looks even closer to the hump facility, however, there is a couple of things which alleviate the situation. The first is the municipal airport which generates noise to mask the railroad activity. The other area directly south contains lots of people who don't complain: it's a cemetery. If one considers

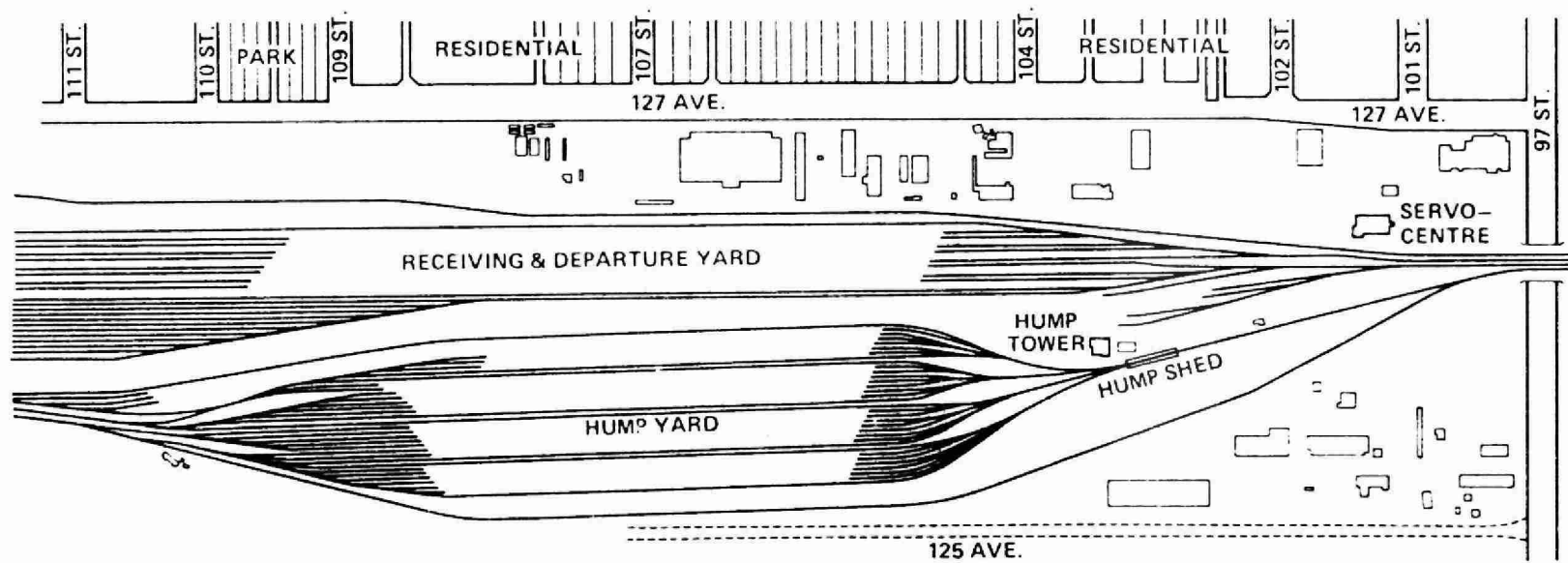


Figure 1

the hump facility the closest housing is about 800 to 850 feet to the north and something over 1200 feet to the south.

The hump is not particularly high only about 13 feet above the surrounding terrain. The facility comprises a master retarder after which the cars are switched onto one of four tracks with second retarders (group retarders). The cars are finally switched onto one of 34 classification tracks and at the end of these there are 34 inert retarders. We have potential noise problems coming from the master retarder, the four group retarders and the inert retarders. All of these from time to time have caused problems. During 1972 noise surveys in the area both north and south of the yard were done to try to get information as to what portion of the noise was due to the CN hump facility. Of course, this is a difficult thing to ascertain as often you could hear the noise but you couldn't see any indication of it on a meter. Also there were some community groups formed such as the "Dump the Hump" committee and questions were raised in the House of Commons.

In response to this, CN decided to see what control measures were possible with respect to retarder noise. The reason for this was, as I understand it, that complaints had not been excessive until the hump facility was introduced and produced these very high pitched squeals which I'm sure many of you have heard. After the noise studies were done a shed was built over the master retarder. This housing was quite effective in reducing the noise from the master retarder, however, the cost of the shed plus the facilities associated with it were in the order of \$125 thousand dollars. There was, of course, still the problem both with the four group retarders and the inert retarders at the other end.

Since the installation of the master retarder housing barriers have also been built next to some of the group retarders. These barriers were built from ten foot slabs of transite panelling which weighs about 4 lbs/square foot. The panels were installed at 60° to the horizontal which gave us about 8 feet above the top of the rail. Since the noise is of a high frequency nature it was expected that the barrier would be fairly effective. Measurements made before and after indicated that the levels were reduced in the order of 20 to 25 decibels which is about the maximum one can expect in this situation. Not all of the four group retarders could be covered because of the physical situation. These barriers were in some cases made only as long as the retarders, however, the initial specification was that they should be at least 20 feet beyond the end so that refraction around the end would not be appreciable. This still meant that the front trucks of the car would be beyond the barrier while the rear ones were in the retarder. The inside surface of the barrier was lined with fibreglass and a metal screening to try to minimize weathering problems. We also recommended that the ends be closed in. The estimated cost of the barriers for the group retarders was \$26 thousand dollars or about \$45/lineal foot of barrier.

I should mention perhaps the construction of the master retarder shed. It was built on a steel structure with the panels made from sheet steel with fiberglass inside. These were manufactured locally by a company by the name of Brytex. This shed extended some distance beyond the end of the master retarder and also has some baffles to reduce diffraction around the ends.

Question: These cars that are being retarded, do they all leave the hump at the same velocity?

Answer: No they don't. There is radar which measures the speed and with a computer controls the track to which the car is finally going. The computer looks to see how full this track is i.e. how far the car must travel and therefore how much if any retardation has to be applied.

Question: There is no decision on how much acceleration the car is given initially?

Answer: No, it is just pushed over the top of the hump. It starts almost from a dead stop. The problem is that as new equipment is introduced there are more and more roller bearings in the cars with the result that they roll better so that more speed must be taken out of the cars.

I would now like to discuss some of the other ways in which noise control has been attempted and the successes and/or failure of the same. In Edmonton CN first attempted to reduce the noise by a lubrication system on the master retarder. First of all it was just dabbing grease on the retarder shoes. This eliminated the noise, however, the problem was that you often had what are called "slip-throughs". Naturally greasing the brake is defeating its major purpose. I believe that the first type CN used was almost like a wheel bearing grease, however, there have been various types tested. I noticed that in the March edition of the "Signalmen's Journal" that Burlington Northern, for example, are using an oil-water mixture which was claimed to reduce the noise considerably. They were using this in conjunction with barriers. The problem is that this is a very messy solution. Classifying thousands

of cars and lubricating them all with water and oil leads to another type of pollution. One other attempt was just to use water, however, tests have shown this to be unsuccessful.

The idea of the lubricants is to eliminate or reduce the stick-slip vibration which occurs between the retarder shoe and the wheel. This method of control attempts to eliminate this stick-slip right at the shoe-wheel interface. While it is believed that the wheel is the primary radiator of the noise, the excitation is the stick-slip phenomena. Question: What is the gap between the top of the barrier and the side of the car?

Answer: The standard clearance for railroads is 6 feet from the gauge while the car is about 5 feet from the track centre so that the gap is about one foot. The idea is that to be as effective as possible you want the barrier to be as close to the source as possible.

To give you some idea of the acoustic power possible in the wheel-retarder system consider the type of car which causes a problem. These are the heavy and extra heavy ones which weigh from 100 to 120 tons. These cars are slowed from about 11 to 12 miles per hour to about 6 or 7 miles per hour. Even if you have a fairly inefficient conversion of the mechanical energy dissipated to acoustic energy the sound power levels are extremely high. Even with the use of acoustic barriers the sound pressure levels at distances of 1000 feet can be quite high.

There have been a number of studies in the US on various retarder yards. One of these was done by Bolt Bernek and Newman for Burlington Northern. The first idea they tried was an attempt to change the natural frequency of the retarder beam and shoe on its supporting structure. The thought was that you might be able to tune the

frequency of the stick-slip vibration so that it would not be a frequency that excites the car wheel. They loaded the retarder beams with 3 tons of sand to lower its natural frequency. They thought that at first the retarders would not be able to move the extra 6000 lbs. but this proved to be false. They had also hoped that the sand would act as a damper to reduce the beam vibration. Unfortunately the sand had no effect as the squeals were just as loud as before and the sand idea was discarded. The other idea to dampen the vibration which these investigators tried was to press wooden beams against the wheels when they were in the retarder. The idea was that the wood would act as a damping material. Again this proved ineffective and it is believed that this was because insufficient pressure was applied to the wheel to cause any real damping effect.

Question: What is the nature or what is the percentage of cars that squeal?

Answer: There is no correlation between the type of car and squeal. All you can say is that the heavier the car the better the chance that the wheels will squeal.

Question: How do you know that the wheel is the major radiator of the sound energy?

Answer: My feeling is that the wheel is the major culprit and this was also the conclusion of BB&N. Also because of the reduction received from the barrier you'd expect that this is the case i.e. that the source must be generally located in the region of the wheel.

One other solution which has been tried is to apply a large disc of dampening material to the wheels. The manufacturer of the material claims tremendous sound reductions for curve squeal. Another

related technique is the use of car wheels which have a rubber insert between the flange and the outer rim to uncouple the rim vibrations from the flange. I believe these wheels have been investigated by the MT&C (Ontario) and I know are being used for the new Edmonton Rapid Transit cars. Even if these solutions work they would not be economically feasible for all railroad cars.

I would now like to spend some time talking about what we have done and what we intend on doing vis-a-vis the retarders at Calder Yards in Edmonton. We began our study of the group retarders by taking data to ascertain the situation at present. We wished to know what was happening to the retarders when the squeals were being generated. This was done in a series of tests in which the same group of ten heavy and extra heavy cars were humped a number of consecutive times. These cars were all squealing loudly. In fact, the levels inside the barriers were in the 130 dB range. During the time in which these cars were being humped, we measured the vibration of the retarder beam in the longitudinal direction i.e. along the direction of the track. As well we measured the vibration vertically and horizontally (perpendicular to the track). Simultaneously we recorded the sound being generated by these vibrations. (A schematic diagram of our instrumentation and the results of some of these measurements are shown in the enclosed paper). The frequency analysis of the signals shows a very strong correlation between the horizontal and vertical vibrations and the sounds generated. In fact there are some very distinct frequencies which show both strong vibrations and sound level. The surprising thing that we noticed was that in almost all of the cars tested there was usually a very large spike

at above 2800 Hz. I had thought initially that the vibration would be a very broadband type but this was certainly not the case. The cars were all kinds from flat cars loaded with scrap iron to Canadian Government wheat cars.

We tried to measure the resonant frequency of the retarder itself and so we excited it by simply impacting it with a mallet and recording the vibrations. From a frequency analysis of this we again see a peak somewhere around 2800 to 3000 cycles. This could mean that one of the troublesome frequencies from the squeal was near one of the resonant frequencies of the retarder itself. The retarder was also excited in the vertical direction, however, any resonant frequencies present were below about 1000 cycles.

The outcome of these tests was the idea that because there was a strong vibration and noise generated in the 2800 Hz range that if one could stop the vibration of the retarder shoe and beam at this frequency that the squeal could be at least reduced or even eliminated.

One device which has been used to eliminate vibration at a specific frequency is the "dynamic vibration absorber". If we consider the retarder and its supports as a simple spring with a mass at the end of it then a dynamic absorber is nothing more than another spring and a mass attached to the first mass that produces a force which is 180° out of phase with the one coming from the wheel-rail interaction. If properly designed these forces will cancel and the main mass (in this case the retarder beam and shoe) should not move. Instead the absorber mass will move. This device will work only over a small frequency range for which it is designed. Our hope was that reducing the retarder

beam motion would reduce the squeal. In theory all that is necessary is to design a spring-mass system of a proper size and tuned to the proper frequency (in this case this is believed to be 2800 to 2900 Hz).

There are of course some difficulties with this system. First of all, you now have a more complicated system but the hope is that the resonances of it will be above or below the region in which stick-slip vibration would occur. Secondly the vibration absorbers which have been used on industrial machines have been used where the frequency is very constant and the vibration is a steady level not intermittent as it is with the retarders. Usually these absorbers run in the range of 30 Hz whereas the frequency which the retarder vibrates at is 2800 Hz.

A first thought was to use a very simple cantilever beam as an absorber. This would be like one tyne of a tuning fork which was tuned to the proper frequency. This did not work as mounting it was very critical to its behaviour. It is hoped to design a better device which could be easily mounted on the retarders. At present we are considering a design which uses a torsional spring instead of a linear one. Whether it will work or not is still open to question.

Acknowledgement: I would like to thank the CNR, Mountain Division for the access to their retarders and information files. In particular, Ivan King and Tony Spencer has been very generous in giving myself and my co-worker Dr. Andrew Mioduchowski all the assistance we have requested.



June 16, 1977.

Mr. John Manuel, Supervisor
Noise Pollution Control Section,
Ontario Ministry of the Environment,
135 St. Clair Avenue West,
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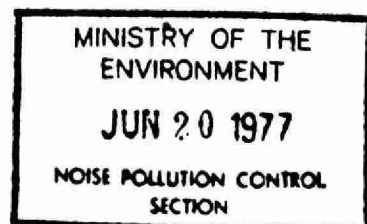
Dear John,

I have enclosed the original copy of "An Investigation of Railroad Car Retarder Squeal" so that you can reprint it if you wish. I would like to get it back when you are finished with it.

Yours truly,

M.G. Faulkner,
Associate Professor,
MECHANICAL ENGINEERING.

MGF:hw
enclosure



An Investigation of Railroad Car Retarder Squeal

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1. Introduction

While the use of humpyards for the classification of railroad cars has been very effective in increasing the volume of cars handled in a yard, one unpleasant by-product of this system is the squeal which is often generated by the retarder systems. As the cars roll down an incline (the "hump") they are slowed by means of a retarder system which usually is two braking mechanisms. These clamp onto the wheels of the car as it passes. The initial retarder, called the master, begins to slow the cars while the second is one of the group retarders. Figure 1 shows three of the group retarders as well as the classification tracks at the CNR Calder Yard in Edmonton. For certain cars (usually the heavier ones) the retarder brake acting on the car wheels causes a high pitched squeal to be generated. The retarders must dissipate energy at rates of up to 400 kW (>500 HP) and even if a relatively small amount is converted to acoustic power high sound pressure levels can result.

Levels of approximately 120dB have been recorded at distances of 100 feet from the retarder. Since most of the acoustic energy is in the 2000-4000 Hz range the squeal tends to be very annoying. Because of the relatively high frequency of the squeal the use of barriers to control the noise seems an obvious answer. While barriers as low as six feet in height have been shown to be effective the practical limit to the insertion loss is about 25 dB. However, this is not sufficient as areas surrounding the retarders can still be severely impacted by the squeals. For this reason alternate techniques which would reduce the noise further have and are being sought.

2. Noise Generation Mechanisms

In order to consider the possible methods for reducing the noise the mechanism which causes the squeal should be understood. While the detailed mechanism for the retarder - wheel system is not known it is believed to be stick-slip vibration or friction induced vibration such as that studied for example by Brockley, Cameron, and Potter [1] and Remington, Rudd and Ver [2].

The screech noise is excited by friction forces that act between the retarder shoes and the car wheels. When these two surfaces have relative sliding motion, intermittent vibration which can be attributed to the variation of the friction forces is observed. For dry friction the motion is a self-excited phenomenon. This occurs because the static coefficient of friction is larger than kinetic coefficient. While the kinetic coefficient is a function of time or the relative velocity between the two surfaces it

must in fact be lower than the static value if stick-slip vibrations are to occur. Once establishing the velocity and time dependence of friction, it is possible to obtain an analytical solution to the critical velocity which will cause this stick-slip oscillation.

The analysis also shows that increasing the damping of the system or altering the friction-velocity characteristic can reduce or eliminate the stick-slip action.

The above analysis would account only for radial type oscillations of the car wheel, however, because of the complex shape of the car wheel the transverse modes are also excited. It is these transverse modes which are held primarily responsible for the generation of the acoustic waves which propagate as the screech.

3. Methods of Controlling the Noise

The techniques used to control or eliminate the retarder shoe squeal include path-type controls such as barriers, which have been mentioned above, as well as modification of the source elements.

One of the easiest and quickest techniques to eliminate the screech was the use of various lubricants between the wheel and retarder shoe. These lubricants had the effect of reducing the differences between the static and kinetic coefficients of friction and proved quite effective in the elimination of the squeal. They did, however, reduce the effectiveness of the retarders and in many cases caused cars to "slip through" which could lead to disastrous consequences.

Another method of modifying the friction forces between the wheel and retarder shoe is to modify the metals in contact. The first metal used for the retarder shoes in place of steel was ASTM 60 ductile iron. While the incidence of squeal was reduced using the ductile iron the sound intensity was similar once the squeal began. As well these shoes wore at approximately four times the rate of steel shoes. Other types of shoes for example those containing nodules of graphite are being tested. These type of shoes have shown improvements as far as reducing the squeals, however, the life of these shoes is considerably less than those of the usual carbon steel ones.

As mentioned above the addition of damping to the stick-slip system could theoretically eliminate the stick-slip action. For this reason damping of both the retarder beams and the car wheels has been attempted. The retarder beams were damped by adding sand bags and loose sand to the top of the retarder beam. This produced no noticeable change in screech level. The car wheels have been damped by attaching a sheet of viscoelastic damping material to the wheels as well as by applying wooden damping shoes which were pressed against the wheels during the time in which the wheel is being braked. The wooden damping shoes had no effect whatever on the wheel screech while the viscoelastic damping did have some positive effect. While the addition of this damping material may be effective the idea of installing it on the thousands of railroad cars in North America makes it an unworkable solution.

More complicated techniques have also been tried. These include modulating the pressure applied to the retarder shoes so that the screech does not "build-up" and the modification of the retarder beam to alter its mass-stiffness characteristic. Neither of these ideas has shown much promise.

4. Current Investigation

One of the humpyards with squeal problems is the CN Calder Yards in Edmonton. This facility has an enclosure built over the master retarder to control the noise, however, the four group retarders have only partial barriers to reduce the transmission of the high frequency squeal from the retarder-car wheel interaction (see Figure 1). In considering possible solutions to the squeal preliminary investigations of the nature of the noise and vibration from this facility were undertaken. The vibration of the retarder beam as well as the squeal produced were monitored simultaneously. A closeup of the retarder beam is shown in Figure 2 while the system used to monitor the noise and vibration is shown in Figure 3.

The recordings were taken on May 13, 1976 while a group of ten cars were humped 5 consecutive times. These cars were all relatively heavy and all of them squealed excessively.

Recordings were taken for vibration in the longitudinal direction (i.e. parallel to the track) and in the vertical direction. Recordings were also taken in the horizontal but perpendicular to the track. As well the natural vibrations which occurred when the track was impacted in the longitudinal direction were also recorded.

The recordings were later analyzed on a Hewlett Packard 3721A Correlator and displayed on a 3720A Spectrum display and finally plotted on a Hewlett Packard 7044A X-Y Plotter.

Examples of the spectrum analysis are shown in Figure 4 where the results for 3 different cars during the first hump are shown. These results as well as similar ones for other cars and other hump numbers show a very strong correlation between the vibrations of the retarder (measured in the longitudinal and vertical directions) and the noise produced. They also indicate that in most cases a large amount of the energy lies in the 2600-2800 Hz frequency range and not in a wide band of frequencies. Coupled with the fact that one of the natural modes of vibration (in the longitudinal direction) is in the 3000 Hz range leads one to believe that the most critical frequency range is the 2600-2800 Hz band. While the magnitudes of the vibration both above and below this range were sometimes substantial the 2600-2800 Hz band was most often the major contributor to the overall acoustic energy.

5. Possible Solutions

While the investigation to date has not uncovered all aspects of the noise generation mechanism the results obtained point to some possible techniques for controlling the noise.

There are many reasons to believe that the wheel and not the retarder beam is the primary resonant system and therefore responsible for the majority of the noise created. For this reason noise control measures which reduce wheel vibration would appear to be most successful. However, the treating of all railroad car wheels appears to be economically unattractive and one is therefore led to consider the retarder. The fact that there is a strong correlation between the vibration of the retarder and the noise generated leads to the conclusion that there is a strong coupling between the wheel and the retarder. It follows that reducing the retarder vibration will in turn reduce the noise generated.

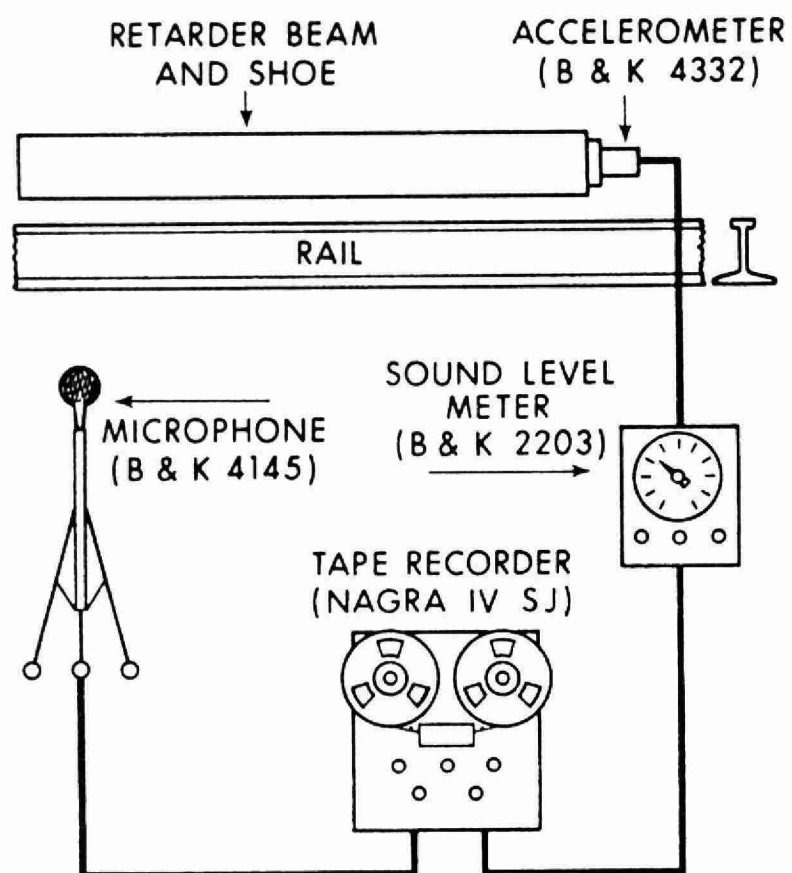
Previous attempts (mentioned above) at damping the retarder beam by such means as sand bags were unsuccessful. However, the possibility of absorbing the retarder vibration by means of a dynamic vibration absorber [3] could be more effective. This is especially true since the frequency which tends to be the most bothersome is in a fairly narrow band of frequencies (2600-2800 Hz). In this range a vibration absorber should be able to be quite effective in nearly eliminating the retarder vibration. Should the absorber vibration itself cause a squeal it could be readily housed and the noise easily absorbed. It is planned to design and test such a dynamic vibration absorber system in the future.

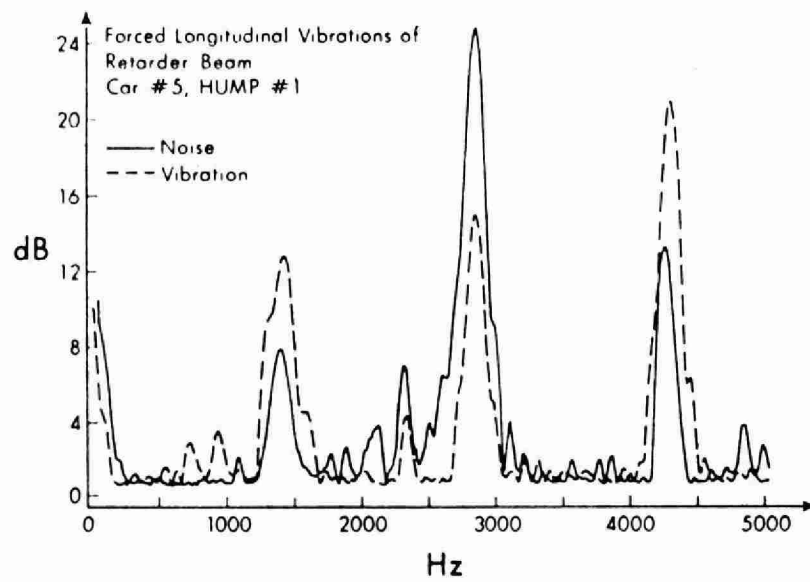
References

- [1] C.A. Brockley, R. Cameron and A.F. Potter, "Friction Induced Vibration", *Journal of Lubrication Technology*, Vol. 89, pp. 101-108, (1967).
- [2] P.J. Remington, M.J. Rudd and I.L. Ver, *Wheel/Rail Noise and Vibration Volume I: Mechanics of Wheel/Rail Noise Generation*, Urban Mass Transportation Administration Report No. UMTA-MA-06-0025-75-10 (1975).
- [3] W.T. Thomson, *Theory of Vibrations with Applications*, Prentice Hall (1972).

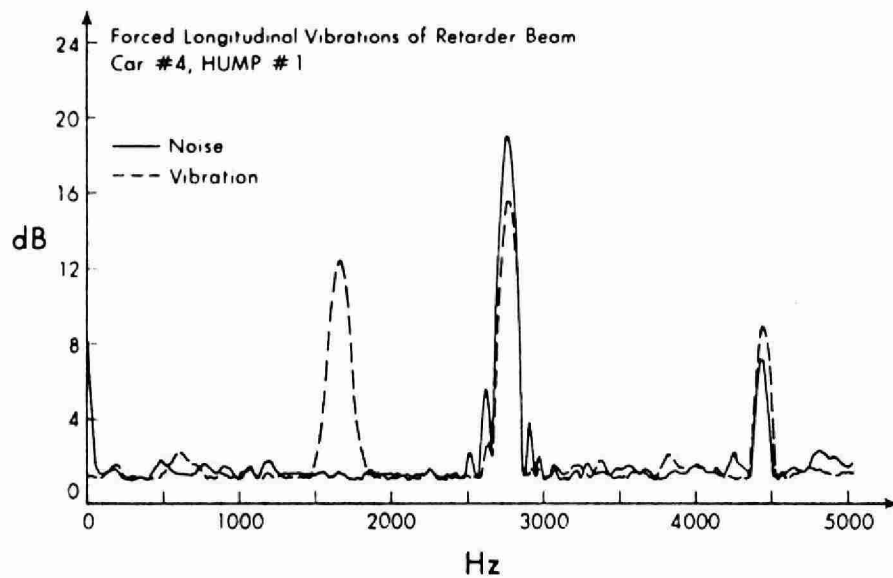
Acknowledgements

The authors would like to express their appreciation to Canadian National Railways, Mountain Division for their help and cooperation in this project. In particular Mr. Ivan King and Mr. Tony Spencer were invaluable in providing the assistance necessary to carry out the testing as well as giving insight into railroad operations.

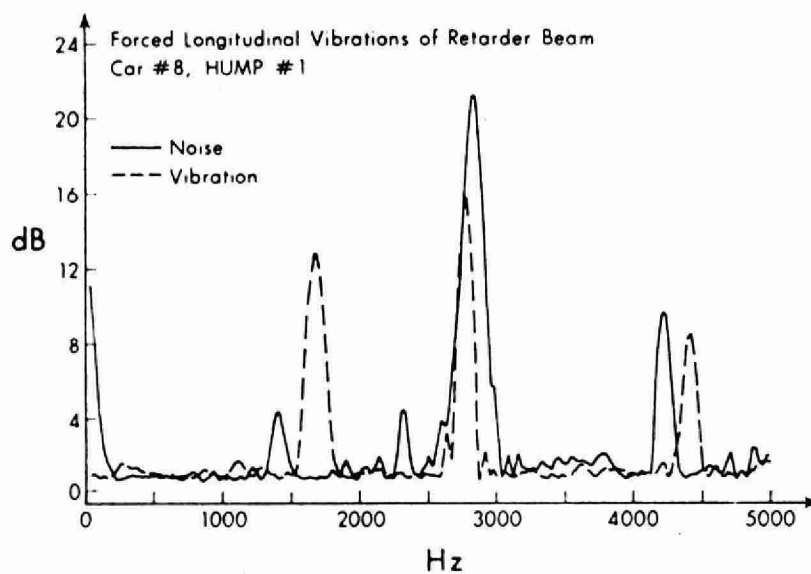




(a)



(b)



(c)

Figure 4



Figure 1



Figure 2

NOISE REDUCTION IN RAILWAY CLASSIFICATION YARDS

C. P. RAIL
Eastern Region
February 13, 1

NOISE REDUCTION IN RAILWAY CLASSIFICATION YARDS

The decision to construct a modern railway classification yard near Toronto was made by CP Rail in the late 1940's, when it was found that the existing railway facilities could no longer handle the rapidly expanding freight traffic of the Toronto area in an effective and efficient manner. After thoroughly examining some 8 or 10 alternate locations, it was determined that the present Agincourt site was the only location, within a reasonable distance from Toronto, where the anticipated future rail traffic could be handled both economically and expeditiously. One of the primary reasons for selecting the present site was because of its remoteness to any large, built-up residential areas and also, because the entire area selected for the yard was located within the industrial zone which was designated in the Official Plan of the Township of Scarborough, approved in 1958.

During discussions with Township Officials back in 1957, it was agreed by all parties concerned, that the project, with its attendant job opportunities, was very timely and, since residential development was minimal in the area, no objections would be anticipated.

The Toronto Yard became fully operational early in 1964, some 20

.../2

years after initial decisions were taken, and an expenditure of over 15.5 million dollars. To ensure effective operation, switching, routing and control patterns had to be set that have implications on rail operations as far away as Montreal, Windsor and Winnipeg.

Attached, as Exhibit I, is a copy of an air photo taken in 1961, which shows the construction of Toronto Yard in progress. It should be noted that there are very few residential dwellings within the general area of the yard.

Exhibit II is a mosaic of a series of aerial photographs taken in 1975, which show the large residential areas which have developed since the start of the Toronto Yard construction. Indicated on the 1975 photograph are other adjacent areas, which have already been committed to future residential development.

Exhibit III is a plan showing the general location of Toronto Yard, and satellite support yards around the Toronto area.

The problem of noise emanating from rail hump classification yards is one that has long plagued North American railroads. Adverse reaction of nearby residents cannot be expected to decrease, as long as adjacent land use is not kept compatible and confined to industrial use, instead of residential. The noise generated

.../3

within a railway yard operation comes from a variety of sources and varies considerably with the activity, the size and motion of the train, the type of equipment, the distance of the listener from the source and climatic conditions. Also, many types of railway noises are intermittent in that the noise is separated by periods of quiet, which tends to be more alerting than would a continuous rumble.

CP Rail has identified several sources of noise at Toronto Yard and has taken the following action in an endeavour to mitigate the difficulty:

1) Slack Take-Up Noise

We are endeavouring through bulletins to workmen and personal training with the operating crews, to reduce slack take-up noise. As part of this, better communication between the hump yardmaster, pulldown supervisors and enginemen is being established so that improved train handling may result.

2) Hump Locomotive Noises

When moving a train on the hump leads, locomotives must be operated slowly in "low gear" so to speak, in order to avoid motor damage and at the present time, a device to muffle this sound simply is not available.

.../4

3) High Powered Locomotive Horns

Locomotives, arriving at Toronto, that are sent to the repair shops for horn deficiency, are checked out, repaired and then tested within the shop. Only when required as a danger warning is the use of a horn employed in the general yard operation.

4) Retarder Screech

The major noise source in any hump yard operation is the screech associated with the retarder operations. The problem of eliminating this screech has been under study by the railway industry and suppliers for several years now, but to date no satisfactory solution has been developed. Some of the suggested solutions that have been tried and the results are outlined as follows:

- 1) Accoustical Barriers: Barriers approximately 8 feet high, extending approximately 15 feet beyond the entering and leaving end of the retarders, are constructed about 10 feet from the centre of track and have sound absorptive surfaces facing inwards towards the wheels. Test results on a number of installations in Canada and the United States have indicated that the level of noise may be reduced about 15 to 20%. The main disadvantage is that the barriers partially block the view of the cars being handled and tend to accumulate snow and ice.

.../5

- 2) Damping the Retarder Beam and Shoe Mechanism: This includes filling the top of the beam mechanism with sand bags. However, during testing, there was no appreciable reduction in sound level.
- 3) Different Brake Shoe Material: Tests have been carried out using cast iron brake shoes to determine the effect on retardation and screech elimination. The results at a number of installations indicated some reduction in the number of cars that squealed. However, of the cars that did squeal, the intensity of the sound was about the same as with conventional brake shoes. The main disadvantage is that cast iron shoes wear away about 5 times faster than steel.
- 4) Lubricants: The use of water spray and oil lubricants applied to the retarder shoes or the car wheels, has been tried at Toronto Yard and at other locations in the United States. It has been determined that the correct formula of oil and water is effective in reducing the screech from certain cars, but a great deal more work is required in this field to perfect this system. The main problem is to determine the exact amount of lubricant to be used, so that it does not seriously affect the retardation of the retarders. It has been found that the use of lubricants can decrease the

.../6

retardation rating by as much as 25%. The other serious disadvantage of lubrication is the potential of ground contamination from the oil spray. Of course, Canadian winter conditions would also present problems.

CP Rail has been in contact with a number of other North American railway companies who have tried and tested some of these alternatives, to determine if there are any satisfactory solutions that could be applied at Toronto Yard. Certain installations do result in some attenuation of noise levels beyond the source, but to date, there is no major installation where the noise is eliminated at the source. A considerable amount of research work is now ongoing in the railway industry and CP Rail will watch this progress attentively for any promising developments.

CP Rail recognizes the specific problem and is willing to adopt some additional measures in an endeavour to mitigate the annoyance, but it should be recognized that it is impossible to eliminate the reception of sounds of yard operations from residents who choose to live near a major railway classification yard.

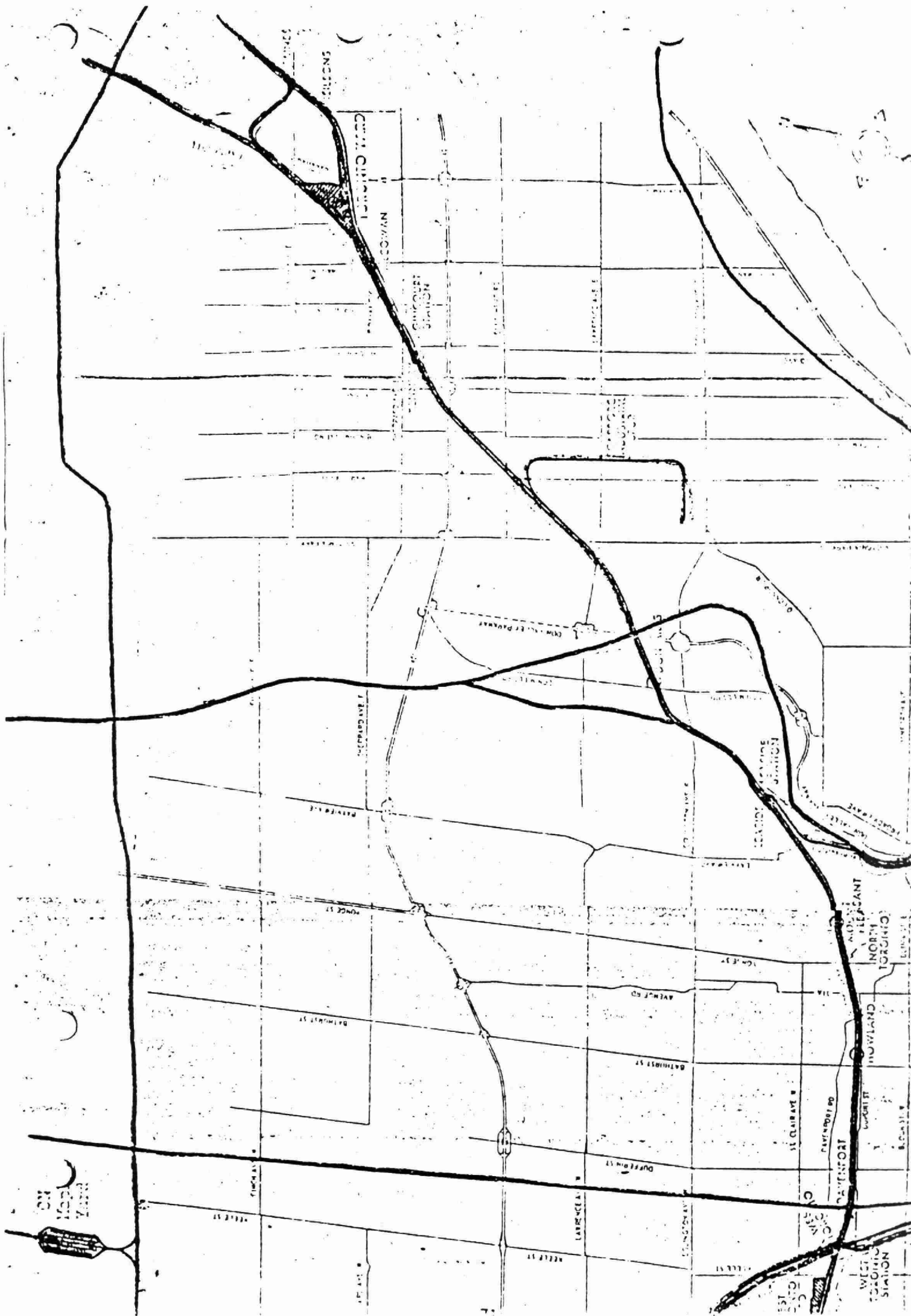
The control of noise emission in railway yards in Canada is most difficult of solution and its perception will become even more

.../7

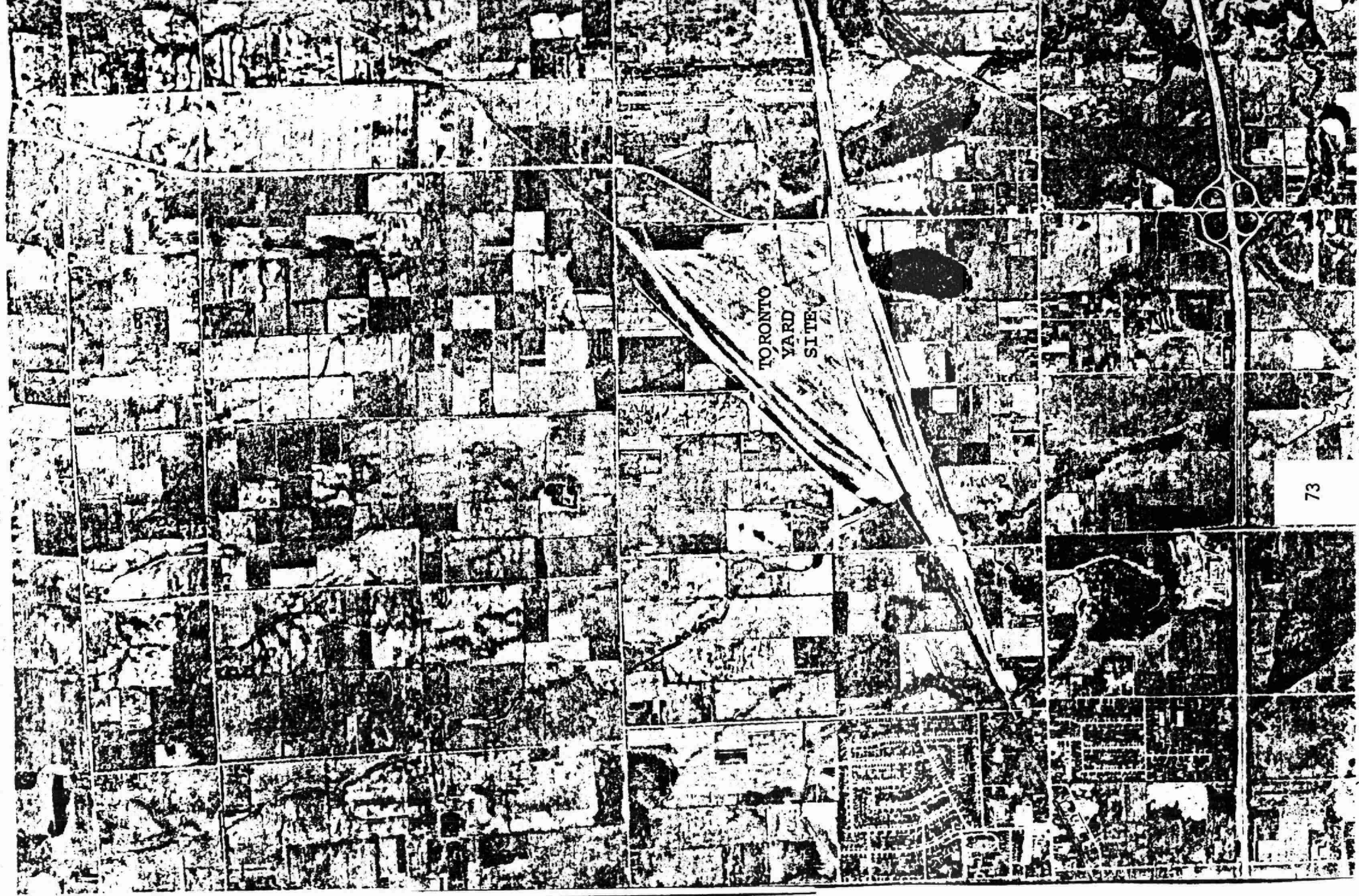
accentuated if zoning authorities continue to permit residential development near railway yards in an unrestricted fashion.

Research in this field will be very time consuming and expensive. Development programs will have to be funded, from which the railways will receive no financial benefit. In as much as the problem is not unique to any one Canadian railway, it is suggested that the National Research Council of Canada undertake an indepth study, assisted by the railways, so that benefits might result to the neighbouring communities and the railways that serve them.

TORONTO, February 13, 1976.







TORONTO
YARD
SITE

NOISE REDUCTION IN CLASSIFICATION YARDS

PRESENTED TO

**AAR
COMMUNICATIONS & SIGNAL SECTION
OCTOBER 1, 1973**

BY

**ROBERT M. KAROW
MANAGER, TERMINAL MARKETS**

**WESTINGHOUSE AIR BRAKE COMPANY
UNION SWITCH & SIGNAL DIVISION
Swissvale Post Office, Pittsburgh, Pa. 15218
An American-Standard Company**

NOISE REDUCTION IN CLASSIFICATION YARDS

FIRST OF ALL, BEFORE WE GET TOO DEEPLY INTO THE NOISE PROBLEM, PERHAPS WE SHOULD ASK, WHAT IS NOISE? NOISE CAN BE DEFINED AS UNWANTED, OR AT LEAST UNDESIRABLE, SOUND. THE NOISE, AND THE PROBLEMS IT HAS BROUGHT ABOUT, THAT I WANT TO TALK ABOUT THIS AFTERNOON IS THE SQUEAL THAT IS PRODUCED AS A CAR PASSES THROUGH A RETARDER.

ALL OF US ARE PRETTY FAMILIAR WITH ELECTRICAL VOLTAGE AND CURRENT MEASUREMENTS AND MOST OF US HAVE SOME SENSE OF "FEEL" FOR 115 VOLTS AT 60 Hz. BUT MOST PEOPLE DON'T HAVE THIS SAME FEEL FOR SOUND OR NOISE LEVELS, OTHER THAN KNOWING THAT THEY DON'T LIKE LOUD SOUNDS OR CERTAIN COMBINATIONS OF FREQUENCIES THAT WE CLASSIFY AS NOISE. THERE ARE A NUMBER OF METERS ON THE MARKET THAT MEASURE SOUND, OR MORE ACCURATELY, SOUND PRESSURE LEVELS. I'VE BROUGHT ALONG ONE MODEL OF SOUND METER THAT WE'VE USED IN OUR MOST RECENT TESTS. THERE ARE SEVERAL MANUFACTURERS OF THIS TYPE OF METER. ALL DO THE SAME THING, MEASURE SOUND LEVEL IN DECIBELS ON SOME SCALE THAT IS USUALLY COMPENSATED TO APPROACH WHAT THE HUMAN EAR SENSES. THE HUMAN EAR DOESN'T HEAR ALL FREQUENCIES EQUALLY WELL. GENERALLY, HUMANS "HEAR" IN THE RANGE OF 50 CYCLES TO 18,000 CYCLES, SOME HIGHER, SOME LOWER. THE EAR IS ESPECIALLY GOOD IN THE RANGE OF 500 TO 5000 CYCLES.

UNFORTUNATELY, THATS WHERE THE SQUEAL OF A WHEEL IN A RETARDER OCCURS, ACTUALLY, ITS SOMEWHERE BETWEEN 2000 AND 3000 CYCLES.

NOISE IN CLASSIFICATION YARDS HAS BEEN A PROBLEM FOR A NUMBER OF YEARS, PROBABLY STARTING WITH THE FIRST RETARDER. A REVIEW OF PRIOR EXPERIMENTS AND TESTING SHOWS A WIDE VARIETY OF APPROACHES TO ALLEVIATING NOISE. A LISTING OF SOME OF THE KNOWN EXPERIMENTS PRIOR TO 1970 IS CONTAINED IN THE ADDENDUM OF THE PRINTED COPIES THAT WILL BE AVAILABLE AFTER THIS SESSION. NO QUANTITATIVE DATA WAS EVER PUBLISHED, SO NO USABLE CONSLUSIONS COULD BE REACHED FROM THESE TESTS AS FAR AS WE CAN DETERMINE. DURING THE LATTER PART OF 1970, THE SUBJECT WAS REVIVED AND BECAME ACUTE DUE TO A LOCAL ORDINANCE THAT SET ALLOWABLE SOUND PRESSURE LEVELS FOR THE PROPOSED YARD AT NORTHTOWN ON THE BURLINGTON NORTHERN.

IN THIS ORDINANCE, MAXIMUM PERMISSIBLE LEVELS FOR NOISE WERE SET AT 35 TO 40 DB AT NIGHT, AND ONLY SLIGHTLY HIGHER IN THE DAY TIME. A GOOD PART OF THE PROBLEM IS THAT SUCH FIGURES ARE TOTALLY UNREALISTIC. NOW THAT'S A SUBJECT IN ITSELF, BUT FOR COMPARISON, 35 DB IS ABOUT THE LEVEL OF A WHISPER. HERE ARE SOME OTHER TYPICAL NOISE LEVELS FOR ADDITIONAL COMPARISON. THE AMBIENT SOUND LEVEL IN THIS ROOM RIGHT NOW IS _____.

REFERENCE -
FIGURE 1

WE MADE MEASUREMENTS OF COMMON NOISES AT EUGENE YARD AND FOUND THAT THE AMBIENT LEVEL WITH NO CARS MOVING WAS 80-85 DB.

A SWITCH ENGINE IDLING PAST AT ABOUT 100 YARDS WAS 90-95 DB.

GENERALLY, WHEN WE HEAR A CAR SQUEAL, WE ARE TALKING ABOUT SOMETHING ABOVE 100 DB. WE'VE RECORDED AS HIGH AS 134 DB 15 FEET FROM A RETARDER. THIS IS VERY CLOSE TO THE THRESHOLD OF PAIN. FORTUNATELY, SOUND DECAYS WITH DISTANCE FROM THE SOURCE SO THAT CHARACTERISTICS CAN PROVIDE A PARTIAL SOLUTION AT SOME LOCATIONS.

AT ABOUT THE SAME TIME AS THE DN WAS FACED WITH THE NORTHTOWN ORDINANCE, THE SANTA FE HAD A LABOR GRIEVANCE INVOLVING RETARDER NOISE AT ARGENTINE YARD. EARLY IN 1971, THE SOUTHERN PACIFIC ALSO BEGAN LOOKING INTO THE PROBLEM IN CONNECTION WITH ITS NEW YARD AT WEST COLTON.

ALL OF THESE RECENT ACTIVITIES WERE RELATED TO THE EVER-INCREASING EMPHASIS ON ECOLOGY AND OUR ENVIRONMENT. THEREFORE, SOMETHING HAD TO BE DONE. OUR APPROACH IN THE TESTS THAT I'LL BE TALKING ABOUT, WAS TO DO THE BEST WE COULD WITH THE NOISE, EVEN THOUGH THE REQUIREMENTS OF CERTAIN ORDINANCES APPEARED TO BE IMPOSSIBLE TO MEET.

AT THE TIME THE SPECIFICATIONS WERE BEING WRITTEN FOR NORTHTOWN, THE BURLINGTON NORTHERN CONTACTED SUPPLIERS OF RETARDERS FOR COOPERATIVE EFFORTS WITH THEIR SOUND CONSULTANT, BOLT BARANEK & NEWMAN (BBN), GENERAL RAILWAY SIGNAL COMPANY AND ABEX BEGAN WORK WITH BBN AND THE BURLINGTON NORTHERN AT VARIOUS LOCATIONS, WABCO ELECTED TO STUDY THE PROBLEM IN CONJUNCTION WITH THE AMERICAN STANDARD RESEARCH CENTER. BOTH EFFORTS PROGRESSED ALONG SIMILAR LINES, BEGINNING WITH THE IDENTIFICATION OF THE NOISE SOURCE. AN EARLY CONCLUSION WAS THAT THE CAR WHEEL IS THE SOUND GENERATOR. (1)

IT IS SET INTO VIBRATION BY THE STICK-SLIP PHENOMENA BETWEEN WHEEL AND BRAKE SHOES CALLED SPRAGGING. AS THE WHEEL IS SQUEEZED, IT TENDS TO BE GRIPPED AND THEN SLIP, SOMEWHAT LIKE A PIECE OF CHALK CHATTERING ON A BLACKBOARD. THE RESULTING VIBRATION CAUSES THE WHEEL TO SQUEAL.

A NUMBER OF TESTS TO ELIMINATE THE NOISE BY DAMPING THE RETARDER BEAM AND SHOE MECHANISM WERE TRIED BY BBN, GRS AND THE BURLINGTON NORTHERN, BUT WITH NO SUCCESS. THESE INCLUDED FILLING THE TOP OF THE BEAM WITH SAND, LOADING THE BEAM WITH SAND BAGS, AND INCREASING THE BEAM MASS WITH SAND BOXES SLUNG

(1) Mr. Francis Kirschner, New Developments in the Control of Railroad Wheel Squeal Noise, 1972, International Noise Control Engineering Conference, Washington, D.C.

UNDERNEATH,⁽²⁾ ADDITIONAL TESTS TO DEADEN THE WHEEL WERE ATTEMPTED BY PRESSING WOOD PLANKS AGAINST THE WHEEL ABOVE THE RETARDER. THESE TOO WERE UNSUCCESSFUL DUE TO CLEARANCE PROBLEMS.

A TEST OF A SOUND DEADENING MATERIAL APPLIED TO THE WHEELS OF A HEAVY CAR WAS PLANNED, BUT NEVER CARRIED OUT DUE TO NOT HAVING SUCH A CAR AVAILABLE FOR A LONG ENOUGH PERIOD OF TIME. THIS MIGHT HAVE BEEN AN ACADEMIC EXERCISE ANYWAY DUE TO THE MAGNITUDE OF APPLYING SUCH A SOLUTION TO ALL CARS. IF AN ANSWER CAN BE FOUND BY WORKING AT THE WHEEL-SHOE CONTACT POINT TO ELIMINATE THE VIBRATION, A MORE ECONOMIC SOLUTION WILL RESULT.

ONE OF THE MOST IMPORTANT RESULTS OF OUR PRELIMINARY TESTING WAS THE DISCOVERY THAT, REGARDLESS OF WHICH DEVICE OR MODIFICATION WAS IN USE, ONCE A WHEEL BEGAN TO SQUEAL, IT SQUEALED JUST AS LOUDLY.

THEREFORE, WABCO, WORKING WITH VARIOUS RAILROADS AND THE RESEARCH CENTER, DECIDED TO APPROACH THE PROBLEM ON TWO FRONTS SIMULTANEOUSLY.

(2) Mr. V. K. Southworth, BA Inc., Noise Problems Involving Retarders, AAR-CES Section Annual Meeting, September 25, 1972.

THE FIRST OBJECTIVE WAS TO FIND SOME MANNER, AS QUICKLY AS POSSIBLE, TO REDUCE THE OVERALL INTENSITY OF THE WHEEL SQUEAL. THE SECOND PROGRAM WAS AIMED AT FINDING SOME METHOD, OR COMBINATION OF METHODS, TO REDUCE THE PERCENTAGE OF CARS THAT SQUEALED TO ABSOLUTE ZERO.

IN REGARDS TO OUR 1ST OBJECTIVE, REDUCING THE INTENSITY OF THE SOUND LEVEL, A SOUND BARRIER WAS DESIGNED BY AMERICAN STANDARD RESEARCH AND SUBMITTED TO THE BURLINGTON NORTHERN FOR CONSTRUCTION AT NORTH KANSAS CITY.

TO DEVELOP A STANDARD FOR COMPARISON, SOUND MEASUREMENTS WERE MADE BY WABCO AT ARGENTINE, NORTH KANSAS CITY AND EUGENE YARD IN THE SUMMER OF 1971. THE BARRIER WAS ERECTED BY THE BN AND SOUND MEASUREMENTS WERE TAKEN IN OCTOBER OF 1971. THIS PROVIDED A PARTIAL SOLUTION. THE FIRST DESIGN REDUCED THE LEVEL BY ABOUT 20 DB. A LATER VERSION REDUCED THE LEVEL BY 25 DB. INCIDENTALLY, WE WERE GRANTED A PATENT ON THIS BARRIER DESIGN IN JULY OF THIS YEAR.

IN ADDRESSING THE 2ND OBJECTIVE WE INVESTIGATED A NUMBER OF POSSIBLE SOLUTIONS. THEY ARE AS FOLLOWS:

- DIFFERENT SHOE MATERIALS
- CHANGES IN THE RETARDER ARRANGEMENT
- CHANGES IN RETARDER CONTROL
- LUBRICATION

THE SOUTHERN PACIFIC COMPARED SOUND TESTS ON NORMAL SHOES AT EUGENE WITH SOUND MEASUREMENTS OF SOFTER (UNHEAT-TREATED STEEL) SHOES. (BRINNELL 200 VS. THE STANDARD @ BRINNELL 290). THE CONCLUSIONS FROM THESE TESTS WERE THAT NO APPRECIABLE REDUCTION IN SQUEAL, IF ANY, RESULTED AND SHOE WEAR WAS SUBSTANTIALLY GREATER. THE LATTER CONCLUSION WAS ALSO REACHED BY THE CNR AT EDMONTON.

FOLLOWING THE UNSUCCESSFUL ATTEMPTS WITH SOFTER SHOES, THE SOUTHERN PACIFIC REQUESTED SHOES MADE OF DUCTILE IRON.

DUCTILE IRON SHOES ARE PRODUCED BY A CASTING PROCESS RATHER THAN THE ROLLING OPERATION THAT IS USED FOR OUR STANDARD STEEL SHOES. THE GRADE OF DUCTILE IRON USED HAS ABOUT THE SAME HARDNESS AS THE SOFT STEEL SHOES WE TESTED, BUT THE METRALLURGICAL CONTENT AND MOLECULAR STRUCTURE ARE DIFFERENT. DUCTILE IRON CONTAINS A FAIR AMOUNT OF GRAPHITE. DUCTILE SHOES WERE INSTALLED AT EUGENE. TEST RESULTS INDICATED SOME REDUCTION IN THE NUMBER OF CARS THAT SQUEALED.

WHILE THE VARIOUS OTHER TESTS WERE BEING CARRIED OUT, THE USE OF COMPOSITION SHOE MATERIALS WAS INVESTIGATED. THE 3M COMPANY WAS APPROACHED FIRST, IN COOPERATION WITH THE BN, BUT 3M QUICKLY CONCLUDED THAT THERE WAS EITHER NO READILY AVAILABLE MATERIAL AND/OR THE SIZE OF THE MARKET DID NOT WARRANT A RESEARCH EFFORT. THE PROBLEM WAS THEN TAKEN UP WITH JOHNS-MANVILLE THROUGH THE WABCO AIR BRAKE DIVISION BECAUSE THEY HAD JOINTLY DEVELOPED THE COBRA (R) BRAKE SHOES FOR TRAIN BRAKING. THEY INVESTIGATED THE USE OF SUCH MATERIALS AND CONCLUDED THAT NONE POSSESSED SUFFICIENT MECHANICAL STRENGTH TO WITHSTAND THE FORCES ENCOUNTERED IN A RETARDER APPLICATION. A NUMBER OF PEOPLE IN THE INDUSTRY STILL FELT THIS WAS THE ROUTE TO GO, SO WE HAD A SPECIAL SHOE MADE WITH "COBRA" MATERIAL IN A DOVETAIL SLOT IN A STANDARD SHOE. THIS SHOE LASTED FOR 86 CARS. I'LL PASS AROUND A SAMPLE CUT FROM THIS SHOE.

AT ABOUT THIS SAME TIME, OUR ENGINEERS CONCEIVED THE IDEA OF INTERRUPTING THE RETARDER BEAM AND SHOE ARRANGEMENT. IT HAD BEEN OBSERVED THAT THE BUILDUP OF VIBRATION TO PRODUCE SQUEALING SEEMED TO REQUIRE SOME AMOUNT OF TIME, VARYING FROM 10 TO 30 FEET OF RETARDER LENGTH.

AT TAYLOR YARD ON THE SOUTHERN PACIFIC IN LOS ANGELES, A REBUILT RETARDER WAS INSTALLED WITH ENTERING AND LEAVING BEAMS EVERY 3 CYLINDERS TO CREATE AN INTERRUPTED RETARDER. DUCTILE SHOES WERE ALSO USED IN THIS TEST. THE RESULTS OF THESE TESTS SHOWED A FURTHER REDUCTION OVER THE EUGENE TESTS, IN THE NUMBER OF CARS THAT SQUEALED.

THROUGHOUT ALL OF THE ABOVE TESTS ON THE SOUTHERN PACIFIC, WE HAD BEEN EXCHANGING INFORMATION WITH THE BN AND THE CNR. THE CN RESEARCH DEPARTMENT HAD TESTED A MODIFIED RETARDER CONTROL CIRCUIT WHICH SHOWED A GREAT DEAL OF PROMISE IN PROVIDING A SUBSTANTIAL REDUCTION IN NOISE. IT HAD BEEN FELT THAT RETARDER NOISE WAS A FUNCTION OF THE AMOUNT OF PRESSURE APPLIED. BASED UPON THIS ASSUMPTION, THEY DEVELOPED A RAMPED VOLTAGE CIRCUIT, USING A WIRED PROGRAM ANALOG COMPUTER, TO PROVIDE RETARDER CONTROL THAT WOULD BRING A CAR DOWN TO THE DESIRED VELOCITY AT A CONSTANT RATE OF DECELERATION OVER THE COMPLETE RETARDER LENGTH, RATHER THAN THE STANDARD APPROACH, WHICH RETARDS A CAR AT THE MAXIMUM RATE UNTIL IT IS DOWN TO SPEED, AND THEN CONTROLS THE CAR TO THAT SPEED THROUGHOUT THE REMAINDER OF THE RETARDER LENGTH.

REFERENCE -
FIGURE 2

AS YOU CAN SEE HERE, WITHOUT THE RAMP VOLTAGE, MOST OF THE RETARDATION TAKES PLACE IN THE FIRST HALF OF THE RETARDERS, WHICH INCIDENTALLY, ALSO INCREASES SHOE WEAR AND THE STRESSES ON THE RETARDER.

THE ACTUAL TEST RESULTS ARE SHOWN IN THE NEXT TWO SLIDES OF SPEED VS. DISTANCE OF TWO MEDIUM WEIGHT CARS IN ONE OF THE GROUP RETARDERS AT ARGENTINE YARD ON THE SANTA FE. FIRST, A CAR WITH THE STANDARD RETARDER CONTROL ENTERED THE RETARDER AT 12.5 MPH AND WAS BROUGHT DOWN TO THE REQUESTED EXIT SPEED OF 7.5 MPH UNDER CONVENTIONAL CONTROL IN ABOUT THE FIRST HALF OF THE RETARDER. IN

REFERENCE
FIGURE 3

THE SECOND CASE, USING RAMP SPEED CONTROL, ANOTHER MEDIUM WEIGHT CAR THAT ENTERED THE RETARDER AT 14.5 MPH WAS BROUGHT DOWN TO THE REQUESTED EXIT SPEED OF 6.5 MPH PROGRESSIVELY THROUGHOUT THE LENGTH OF THE RETARDER.

REFERENCE -
FIGURE 4

THE CIRCUIT CREATES A RAMPED VOLTAGE AND OUTPUTS THIS AS A CONSTANTLY DECAYING SPEED REQUEST. THIS VOLTAGE IS, THEORETICALLY, A SLOPED STRAIGHT LINE. THE RESULTING VELOCITY, AS YOU MAY HAVE NOTICED, IS SLIGHTLY WAVY. THIS IS DUE TO THE REACTION TIME OF THE CONTROL CIRCUIT AND RETARDER COMBINATION.

THE RESULTS OF SEVERAL DAYS OF TESTING BY THE CN AND OUR TESTS AT ARGENTINE AND NORTH KANSAS CITY INDICATED A 50% REDUCTION IN THE NUMBER OF HEAVY CARS THAT SQUEALED, AND AN EVEN GREATER REDUCTION WITH MEDIUM WEIGHT CARS USING THIS METHOD OF CONTROL.

THERE WAS NO SQUEAL WITH LIGHT CARS IN EITHER CASE IN THESE PARTICULAR TESTS.

THIS RAMP CONTROL CIRCUIT WAS MADE-UP IN STANDARD 5" X 7" PRINTED CIRCUIT BOARD FORM FOR THE TESTS AT ARGENTINE AND NORTH KANSAS CITY AND HAS SINCE BEEN INSTALLED BY THE CN FOR THEIR RETARDERS AT EDMONTON.

IT REQUIRES A MINOR AMOUNT OF WIRING CHANGES TO FEED THE CIRCUIT WITH THE MEASURED ENTERING VELOCITY (V_1) AND THE CALCULATED REQUESTED LEAVING SPEED (V_2) FROM THE NORMAL SPEED CONTROL CIRCUITRY AS WELL AS BATTERY CONNECTIONS.

THE REMAINING NOISE REDUCTION APPROACH WAS THE USE OF LUBRICATING FLUIDS AT THE RETARDER SHOES.

OIL SPRAY EQUIPMENT WAS SUPPLIED AND INSTALLED BY WABCO AT NORTH KANSAS CITY AND MEASUREMENTS TAKEN AT THE SAME TIME AS THE POST INSTALLATION TESTS OF THE BARRIER.

THIS SLIDE SHOWS THE LUBRICATION EQUIPMENT. IT CONSISTS OF A SERIES OF NOZZLES ON A HEADER PIPE RUNNING DOWN BOTH SIDES OF EACH RAIL WITH A STEEL TROUGH BELOW THE RAIL TO COLLECT THE RUN-OFF. A WATER SOLUABLE OIL IN A 10% SOLUTION WAS SPRAYED ON ALL WHEELS AS THEY PASSED, USING THE YARD AIR SUPPLY TO PROVIDE PRESSURE.

THE SPRAY WAS CONTROLLED MANUALLY WITH A SWITCH AND SOLENOID VALVE FOR THESE TESTS. SOME OTHER TYPE OF MANUAL OR AUTOMATIC CONTROL WOULD BE NEEDED FOR A PERMANENT INSTALLATION.

EACH OF THE TESTS I'VE TALKED ABOUT WAS RUN WITH ONE, OR NO MORE THAN TWO, OF THE NOISE REDUCTION SCHEMES AT A GIVEN TIME. OF COURSE, IN EACH TEST, THE SQUEALERS THAT WERE ELIMINATED FROM THE TOTAL POPULATION WERE THOSE THAT WERE LEAST SUSCEPTIBLE TO SQUEALING.

WE KNEW OF NO WAY TO PREDICT WHAT THE LOWEST PERCENTAGE OF SQUEALERS WOULD BE WITH ALL OF THE ARRANGEMENTS IN COMBINATION, SO THIS PAST JULY, THE BURLINGTON NORTHERN AND WABCO PUT IT ALL TOGETHER AT NORTH KANSAS CITY USING THE GROUP 1 RETARDER FOR TESTS. THIS IS THE RETARDER WITH THE NOISE BARRIER. GROUP RETARDERS 2 AND 3, WITH STANDARD SHOES, WERE USED AS CONTROLS FOR THE TESTS.

THE FIRST SET OF DATA OF THESE LATEST TESTS WAS TAKEN WITH DUCTILE IRON SHOES ON THE INSIDE BEAMS AND WITH TAPERED ENTERING AND LEAVING BEAMS INSTALLED AT EVERY 3RD CYLINDER.

THE EFFECT OF THIS ARRANGEMENT, THE YELLOW BARS, CAN BE SEEN FOR EACH WEIGHT CLASS FROM A COMPARISON WITH GROUP RETARDERS 2 AND 3, WHICH HAD STEEL SHOES IN THE STANDARD ARRANGEMENT. THE NEXT SET OF DATA, INDICATED BY THE GREEN BARS, WAS TAKEN WITH THE RAMP SPEED CONTROL CIRCUIT ADDED.

THIS SLIDE SHOWS THE DIFFERENCE BETWEEN THESE TWO RUNS. THE RESULTS DUPLICATE THE DIFFERENCES FOUND IN THE EARLIER TESTS.

REFERENCE - THE FINAL SET OF DATA, THE BLUE BARS, WAS THEN TAKEN,
TABLE 1 ADDING LUBRICATION TO THE PREVIOUS ARRANGEMENT.

REFERENCE - THE RESULTS OF ALL NOISE REDUCING ARRANGEMENTS IN
FIGURE 5 COMBINATION WAS ZERO SQUEALERS. WE WOULDN'T WANT TO GO SO FAR AS TO SAY THAT ALL THESE APPROACHES IN COMBINATION WILL GUARANTEE TO ELIMINATE ALL SQUEALERS, BECAUSE AT SOME OTHER YARD, WITH SOME OTHER MIX OF CARS, WITH A DIFFERENT RETARDER PRESSURE AND DIFFERENT CLIMATIC CONDITIONS, ON A GIVEN DAY I'M SURE WILL FIND

SOME CAR THAT WILL SQUEAL. WE CAN SAY, HOWEVER, THAT THESE APPROACHES WILL MAKE A BIG DENT IN THE NUMBER OF SQUEALERS.

TO REPEAT ONE OF THE IMPORTANT CONCLUSIONS FROM ALL OF THE TESTS; ONCE A WHEEL BEGINS TO SQUEAL, IT APPEARS TO THE HUMAN EAR THAT IT SQUEALS JUST AS LOUD AS IT WOULD HAVE WITHOUT ANY OF THE RETARDER MODIFICATIONS. THUS, WE CONTINUE TO RECOMMEND NOISE BARRIERS, TO TAKE THE TOP

REFERENCE - 25 DB OFF OF ANY NOISE THAT IS GENERATED. IT ALSO PROVIDES
FIGURE 6 VISABLE PROOF TO THE COMMUNITY THAT SOMETHING HAS BEEN DONE, AND AFTER ALL, THERE IS SOME EMOTION MIXED IN WITH THE PHYSICAL PROBLEM SO A LITTLE PSYCHOLOGY HELPS TOO.

THERE'S ALSO A LITTLE BAD NEWS ABOUT THESE NOISE REDUCTION ARRANGEMENTS THAT SHOULD BE BROUGHT OUT. ALL OF THE BENEFITS MENTIONED AREN'T ACHIEVED WITHOUT SOME LOSS. THE DUCTILE SHOES PROVIDE APPROXIMATELY THE SAME AMOUNT OF RETARDATION AS THE STANDARD HEAT TREATED ROLLED SHOES, BUT THE LIFE OF THE DUCTILE SHOES WHEN INSTALLED ON THE INSIDE BEAMS IS REDUCED BY ABOUT 2/3.

THE INTERRUPTED BEAM APPROACH, THAT IS, ENTERING AND LEAVING BEAMS AT EVERY 3RD CYLINDER, REDUCES THE RETARDER RATING BY 12%.

LUBRICATION FURTHER REDUCES THE RETARDER RATING. THE LATEST TESTS AT NORTH KANSAS CITY INDICATE THIS LOSS TO BE AROUND 25% AND OF, COURSE, THERE'S THE ADDITIONAL COST OF THE SPRAY EQUIPMENT AND OIL AND THE OIL RECOVERY PROBLEM.

THERE IS A LOT MORE WORK THAT CAN BE DONE. WE'VE BEEN ACTIVELY WORKING ON THE PROBLEM FOR OVER 2 YEARS WITH SOME PRELIMINARY TESTS GOING BACK SEVERAL YEARS BEFORE THAT. WE OWE A LOT OF THANKS TO THE CN, THE SP, THE SANTE FE AND THE BN FOR THEIR COOPERATION IN ALL OF THE TESTS. THE LATEST SERIES MEANT SHUTTING DOWN NORTH KANSAS CITY YARD FOR ABOUT 6 HOURS JUST TO GET THE RETARDER RATING DATA ON 35 CARS WITH AND WITHOUT LIBRICATION.

A BROADER RESEARCH EFFORT THAT WOULD INCLUDE WORKING WITH CAR WHEELS AND RETARDERS TOGETHER IS NEEDED. THIS IS BEYOND THE SIGNAL SUPPLIERS PROVINCE AND WILL REQUIRE THE COOPERATION OF WHEEL AND CAR BUILDERS.

WE PLAN TO CONTINUE WITH OTHER EXPERIMENTS ON RETARDERS WHICH COULD RUN FOR SEVERAL YEARS. OUR GOAL IS A MORE ECONOMICAL SOLUTION. IN THE MEAN TIME, WE THINK THE ARRANGEMENTS TRIED SO FAR EITHER SINGLELY, OR IN COMBINATION, CAN PROVIDE AN ACCEPTABLE SOLUTION FOR MOST LOCATIONS.

CHARACTERISTIC SOUND LEVELS

35dB	Whisper
35 - 40dB	Ordinance At Northtown Yard
60 - 65dB	Typical Ambient, Residential Area At Night
70 - 75dB	Typical Office
90 - 95dB	Switch Engine Idling At 100 Yards
104dB	Air Whistle At 50 Yards
100 - 134dB	Car Wheels In Retarder At 15 Feet

Figure 1

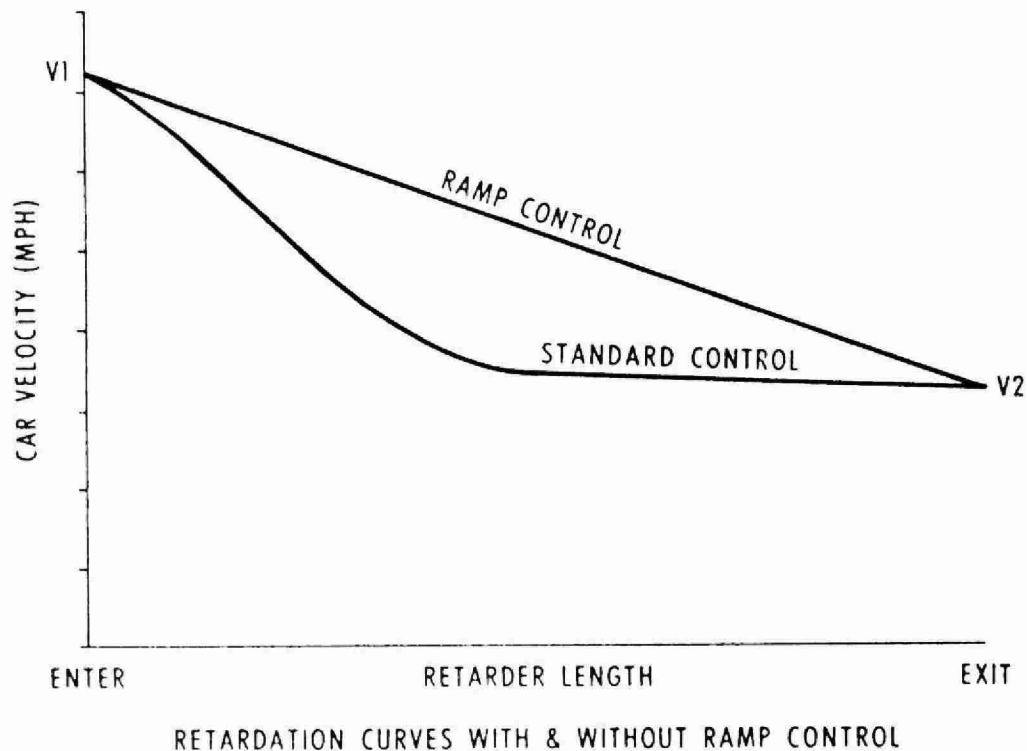


Figure 2

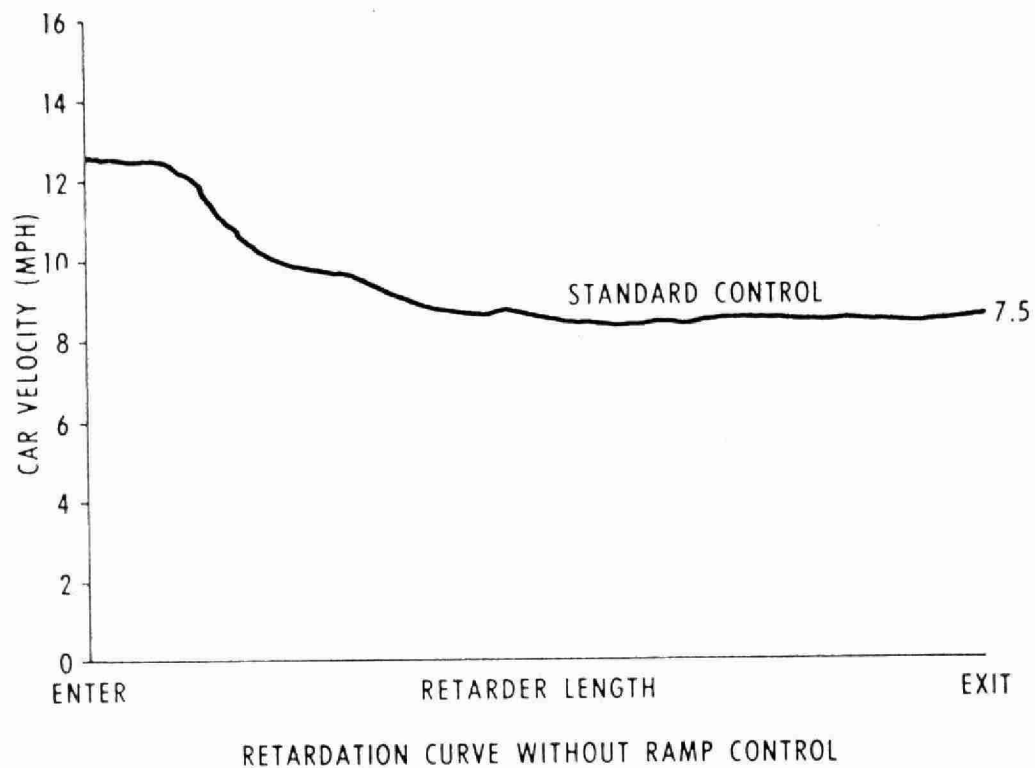


Figure 3

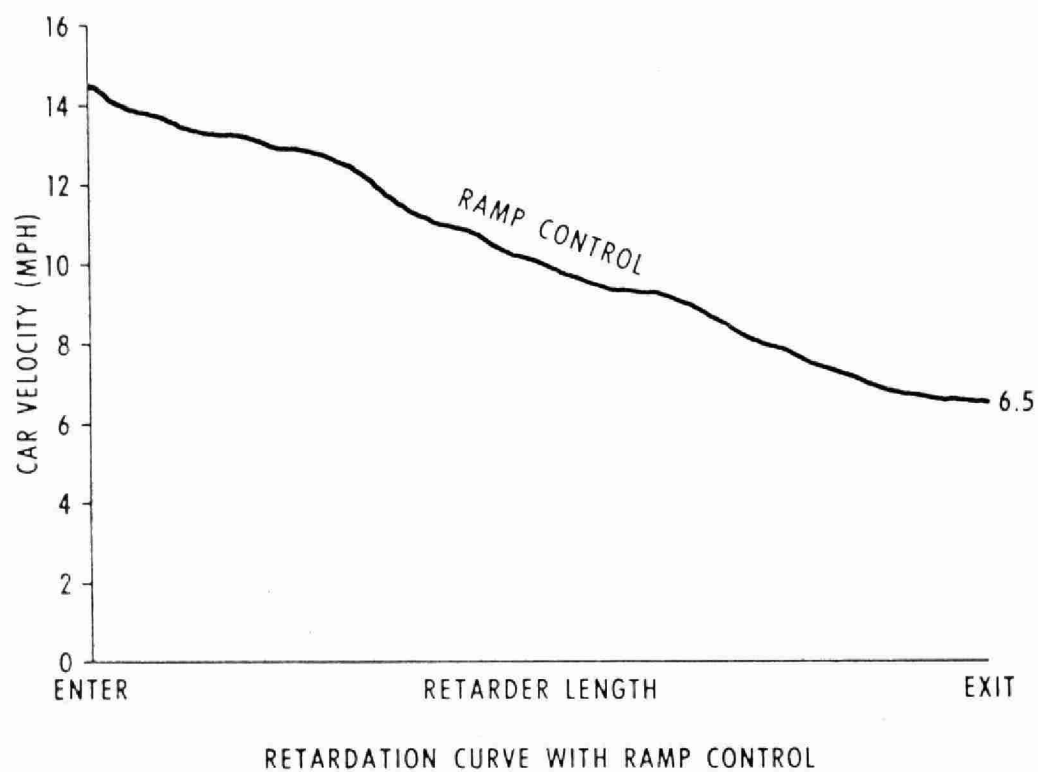
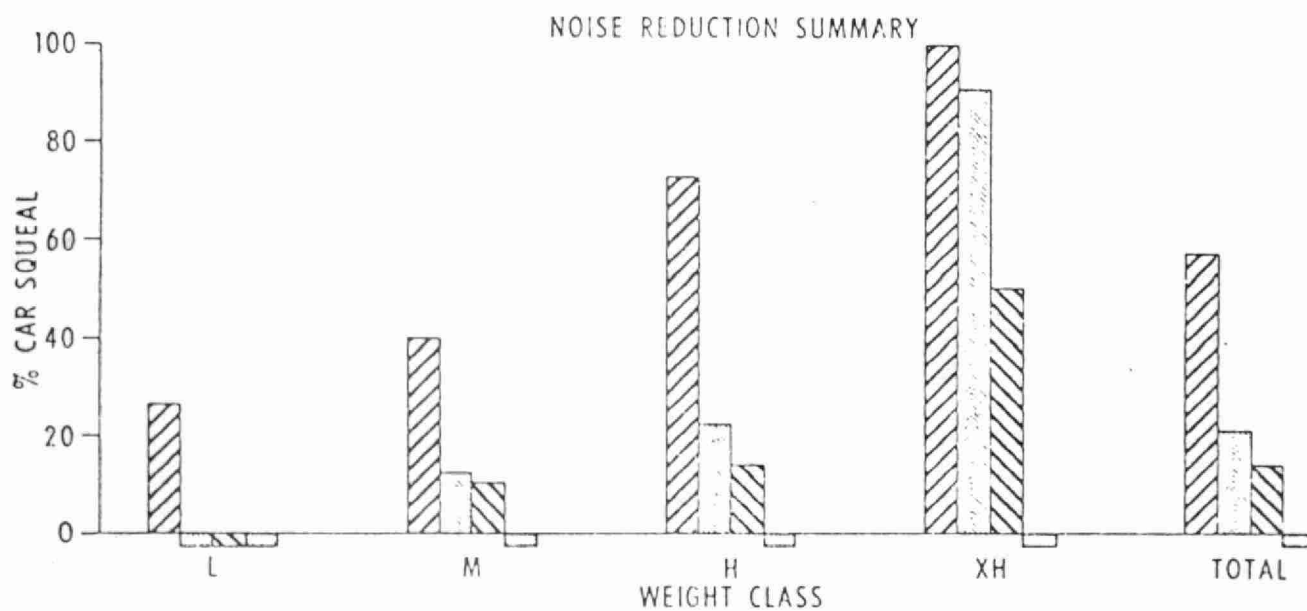


Figure 4



▨ = STANDARD

□ = D.I. SHOES INT. BEAMS

▤ = D.I. SHOES INT. BEAMS RAMP CONTROL

□ = D.I. SHOES INT. BEAMS RAMP CONTROL LUBRICATION

Figure 5

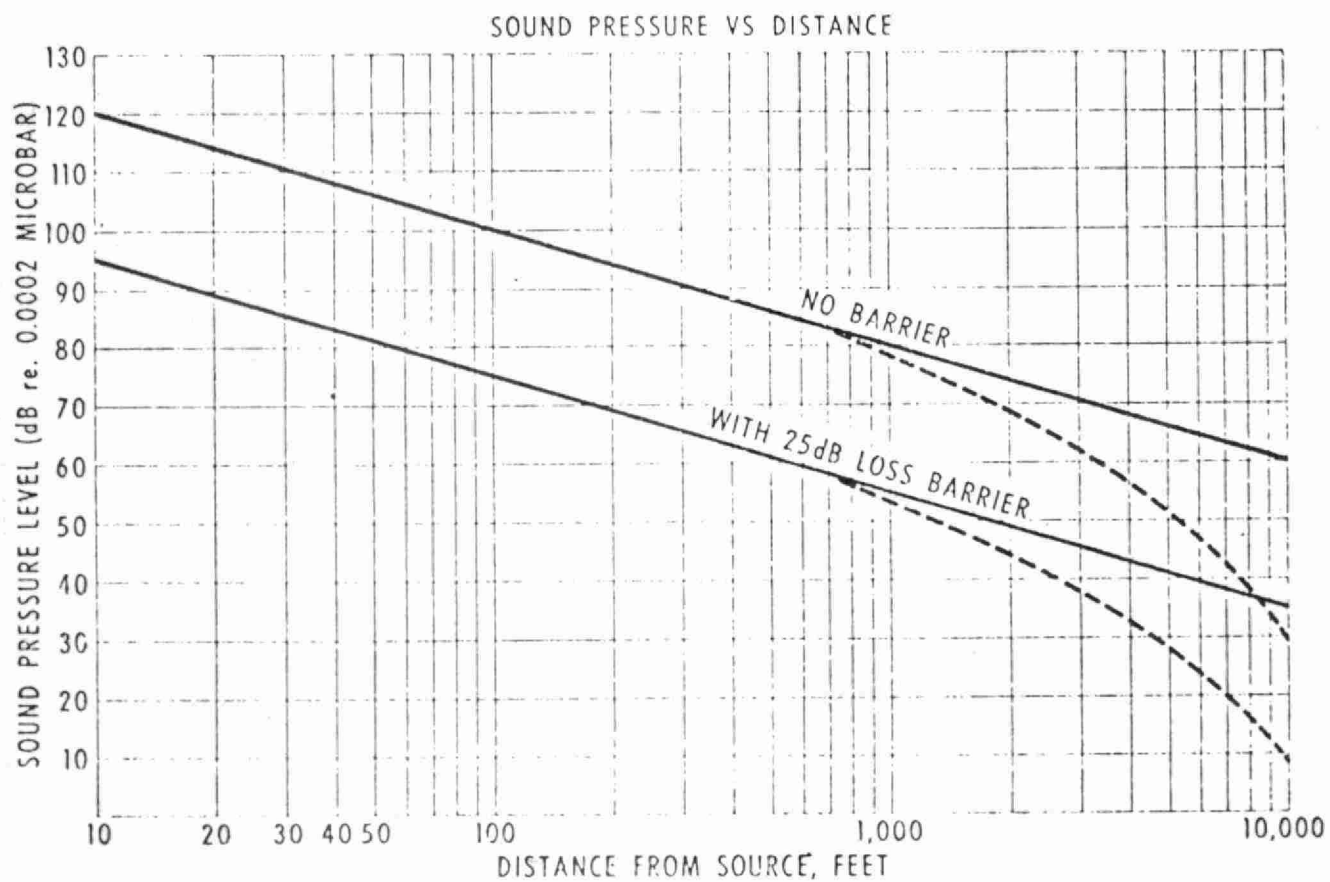


Figure 6

TABLE 1

SUMMARY OF TESTS

	<u>I</u>	<u>II</u>	<u>III</u>	<u>XII</u>	<u>TOTALS</u>
TEST CONTROL RETARDERS #2/3 STANDARD SHOES, STANDARD BEAM ARRANGEMENT.	27% OF 70	27.5% OF 40	72.6% OF 73	100% OF 16	57.6% OF 196
TEST RETARDER #1, DUCTILE SHOES,	0% OF 22	12% OF 39	22.3% OF 57	90.9% OF 11	29.3% OF 139
PLUS RANGE CONTROL	0% OF 16	19.2% OF 25	14.2% OF 42	50% OF 3	14.2% OF 91
PLUS LUBRICATION	0% OF 2	0% OF 14	0% OF 13	0% OF 1	0% OF 35



ADDENDUM

RETARDER NOISE REDUCTION

TESTS PRIOR TO 1970

The following is a summary of some of the various tests conducted prior to 1970 with retarder brake shoes in attempts to alleviate the wheel squeal inherent with car retarder operations.

1. Fabrecka pads were applied between the brake shoes and the beams of a model 31 retarder. This test was unsuccessful in that the brake shoe bolts did not stay tight.
2. On the theory that a lower degree of hardness would eliminate the squealing, standard brake shoes not heat-treated were installed in an inert retarder at the Iron Ore Company of Canada. According to the report received from the railroad, no reduction in squealing was evident with the softer shoes. The life of these shoes was only 60 to 70% as much as that of normal shoes.
3. One railroad experimented with cast grey iron shoes. These shoes did lessen the noise considerably, but the brake shoe wear was so great that the life was estimated to be about 5% of the originally supplied shoes.
4. Manganese cast steel shoes were used by one railroad, but there was still excessive squealing during operations.
5. Extensive tests were made on the Burlington-Northern Railroad. Cicero Yard, using shoes made of ductile iron as the braking material. Ductile iron is a casting material, which on a strength scale would be located between a cast iron and a cast steel. The ductile iron was cast into strips 1/2" thick, approximately 2" wide. The strips were finish machined into shape so that fitted into a dovetailed groove machined into the braking face of the brake rail. Enough pieces were fitted into the groove to fully face the inside of the brake rail.

The pieces were held in place by brazing both ends and tacked with 6" of brazing approximately every 6' at intermediate points. Shoes of this type provided wear for a maximum of 15,000 cars. Standard shoes last for approximately 750,000 cars. This test was made on an American Brake Shoe spring type skate retarder. These shoes were judged to eliminate approximately 90% of the wheel squeal. There was some squeal at speeds of four to five miles per hour, but above and below these speeds there was almost no squealing.

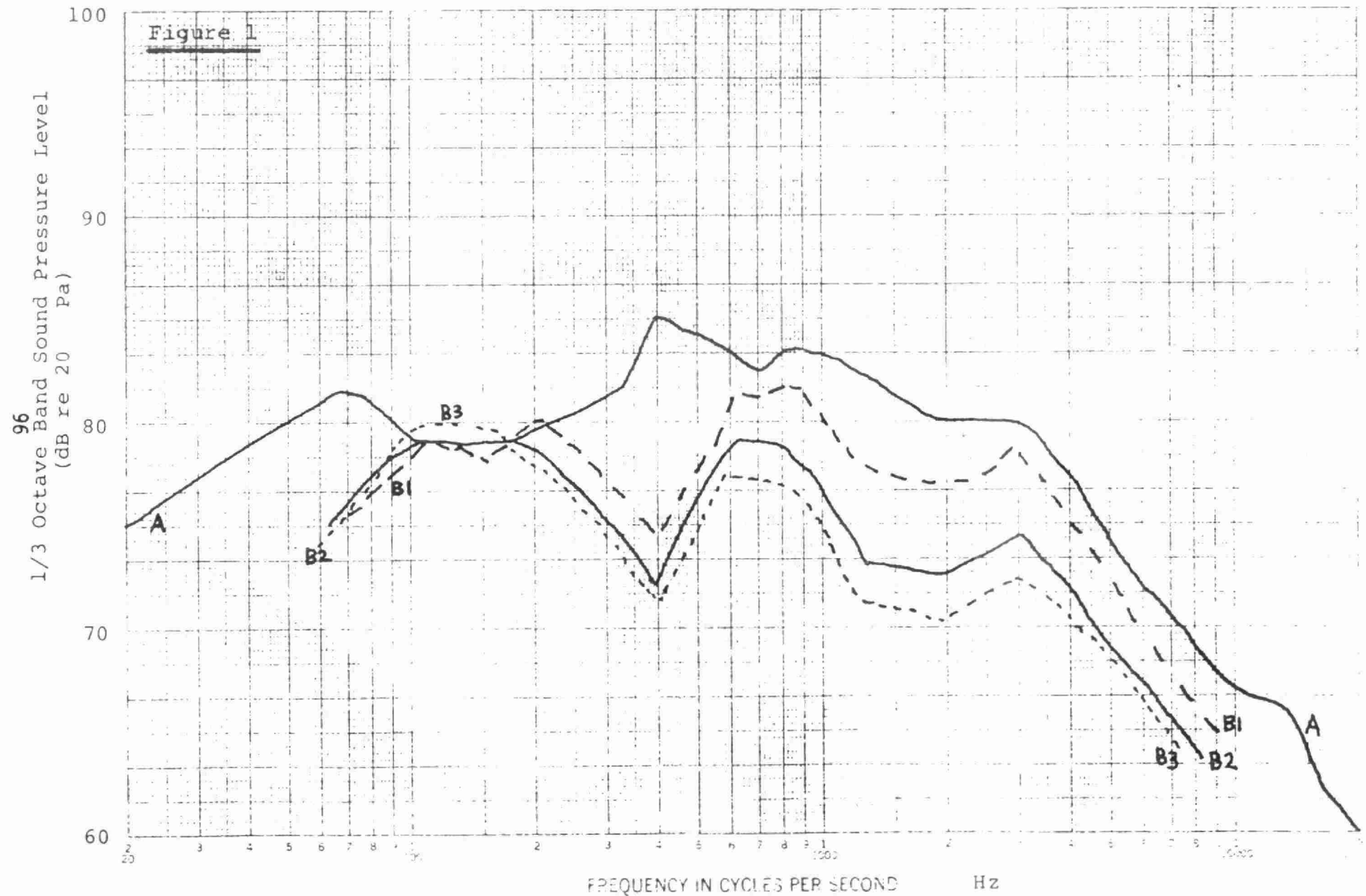
6. The Burlington tried other approaches to the problem at Cicero Yard. Some of these were:
 - a. Spray mastic coating on brake rail (1/2" thick) worked well in noise elimination, but could not keep mastic permanently adhered to brake rail; approximate life ten days to two weeks.
 - b. Spray on plastic coating, polyurethane, 1/4" thick, plastic adhered well but did not eliminate noise.
 - c. Cut vertical grooves in rail -- 1/4" wide every 4" along rail. No squeal elimination.
 - d. Spray diesel oil as cars are pulled through. Squeal reduced, but continuous oil spray became objectionable, both from oil on ground and from oil on retarder reducing retardation.
7. Test brake shoes were made up for an American Brake Shoe retarder. One-quarter inch holes were drilled every 6" along the brake rails and plugged with lead. This test showed no improvement in wheel squeal elimination. This test was repeated, drilling as many 3/4" diameter holes in the 2" rail face as could be located there extending the full length of the brake rail. The holes were all plugged with lead. This did reduce the squeal some, but also reduced the retarding effort.
8. One of the more successful attempts to eliminate wheel squeal was made in 1965 by Iron Ore Company of Canada. This test was made on a WABCO inert retarder equipped with standard brake shoes. The retarder handled only roller bearing cars. The face of the brake shoe was slotted the entire length, 1/8" wide and 1" deep. The slot was packed with brake cylinder lubricant. The last report stated that these shoes reduced the squealing approximately 75% with no extensive loss of shoe life.

One-third Octave Band Analysis of Rolling Noise

Key A - Electric Intercity Passenger Train at 100 mph (45 m/s)

Key B1, B2, B3 - Urban Rapid Transit Train, averages of many spectra at 50, 40, 35 mph
(22, 18, 16 m/s) respectively (Ref. 2)

All measurement at 50 ft. (15 m) on level grade, continuous welded rail, ties, stone ballast.



WHEEL-RAIL NOISE COMMON TO MARSHALLING YARDS

A Literature Survey

BY I. BORDIGNON

TYPE OF NOISE

- A Rolling
- B Impact/impulse
- C Squeal/screech

A ROLLING NOISE

Wheel/rail interaction

For rail cars on uncorrograted straight continuous welded (CWR) railtrack, wheel-rail noise is a steady roar called 'rolling noise'. More commonly associated with high speed cars than low speed cars. Narrow band analysis reveals no tonal components. Broad ^(1,2) band spectra is A-weighted and reveals the decade from .3 to 3 KHz to be dominant. See Figure (1). Rolling noise can be said to be the least annoying, relative to impact or squeal noises, since the tonal component is lacking in the spectra. Since the major cause of this noise stems from wheel/rail irregularities, it is essential to maintain the wheel/rails in good smooth operating condition.

Other ⁽³⁾ parameters which affect rolling noise propagation are:

- (1) rail structure, jointed or welded
- (2) resilient rail fastenings
- (3) concrete or wood bedding for rails
- (4) ballast-mat, in order to isolate vibrations borne from track to bedding (use of rubber mats between rail and bedding)
- (5) use of body skirts on cars in order to reduce noise radiation

REFERENCES

A - ROLLING NOISE

- (1) E. Jrickley et al, U.S. Department of Transportation,
Report DOT-TSC-OST-73-18 Sept. 1973
- (2) C. Blair et al, Course Report to Prof. R.H. Lyon
Mit Cambridge, MA May 1974
- (3) Noise and Vibration Characteristics of High Speed
Transit Vehicles
Wilson, Ihrig and Associates, Incorporated
Berkeley, California June 1971

B IMPACT/IMPULSE NOISE

Car Impacts

Car impacts are one of the more randomly distributed sources of noise in a rail yard. Car impact noise arises from two causes:

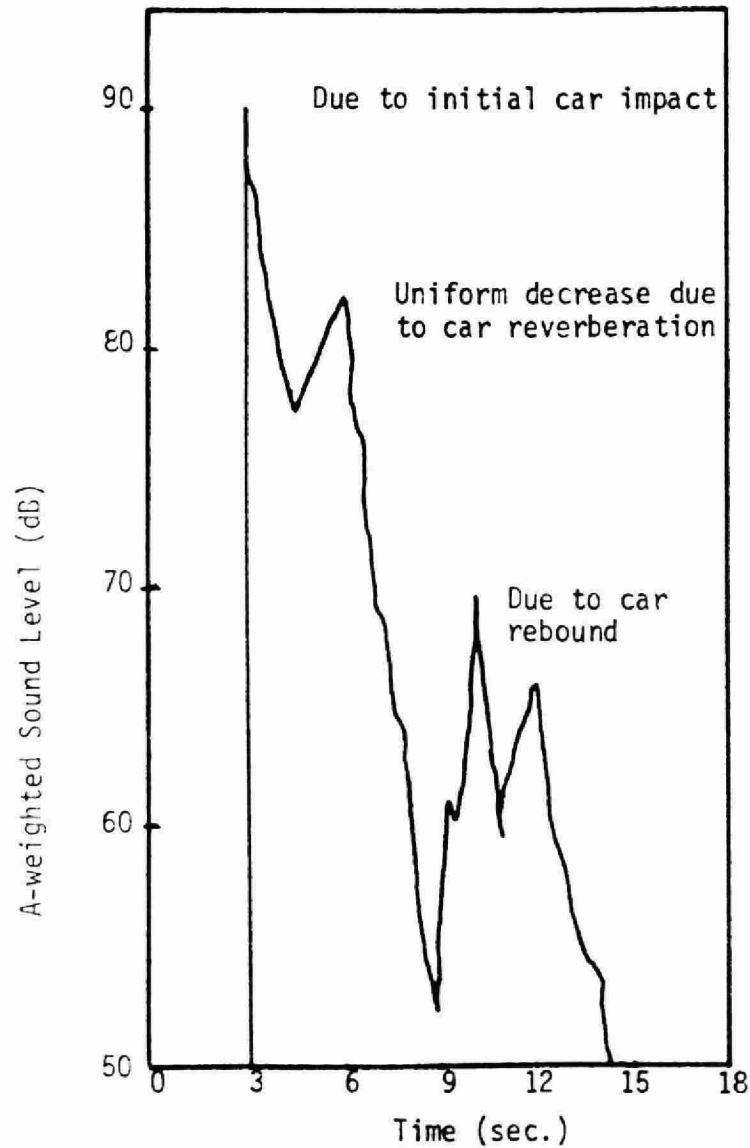
- i) coupling of an additional individual car or group of cars;
- ii) when the slack in the coupler assembly of a line of cars is suddenly taken out or in. The amount of acoustic energy produced in a car impact varies accordingly to the car configuration outlined above.

Car impact noise is characterized by a sharp rise in level followed by a uniform rate of decay. The impulse rise originates at the point of coupler (knuckles) impact, which transmits vibration into the body of the car. The decay corresponds to the reverberation of the car's structure. A secondary peak is caused by the rebound of one car from another taken up by the coupling device, see Figure (2).

The distribution of peak values of the A-weighted levels generated by car impacts is very narrow. The mean value is approximately $125 \text{ dB(A)} \pm 5 \text{ dB}^{(1)}$. Non-uniform impact velocities of cars account for data variation, see Figure (3).

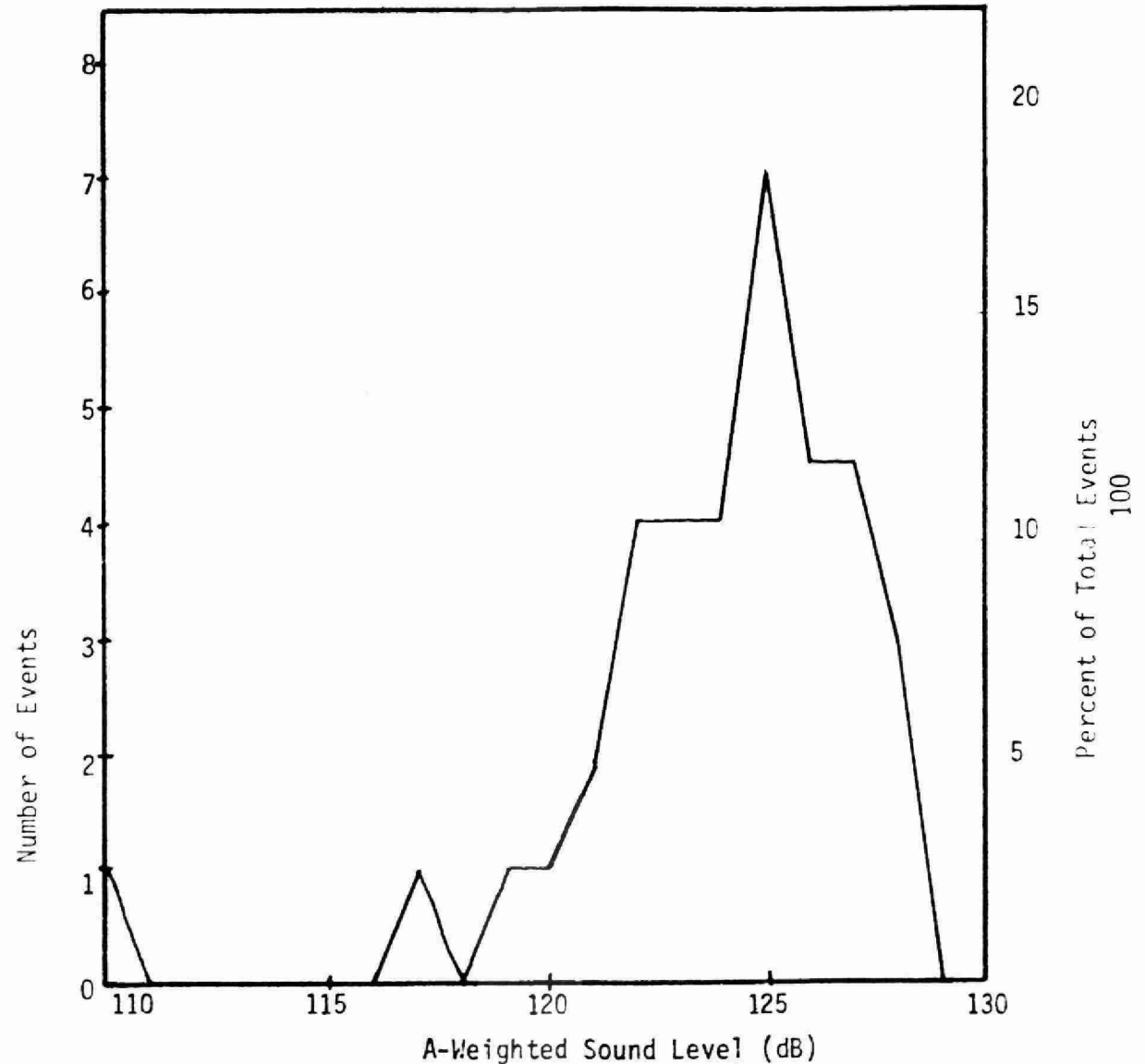
"The level of noise from impacts appears to be a function of relative velocity between cars, types of cars, type of coupler (cushioned or non-cushioned), weight of cars, size and weight of load and possibly spring rate of car's suspension."⁽²⁾ Since at any point in the yard, these vary randomly with time, it is difficult to mathematically predict impact levels.

Fig. 2



Time History of Car-Car Impact Noise at 125 ft.

Fig. 3.



Amplitude Distribution of Car Impact Noise

Comprehensive analysis of car impact noise levels was performed by Bender, et al., (1974)⁽³⁾ with noise levels at 30m typically ranging from 95 to 100 dBA. Bender⁽³⁾ also determined the equivalent energy level (L_{eq}) resulting from 1000 impacts per day to be 76 dBA at 30 meters.

REFERENCES

B - IMPACT/IMPULSE NOISE

- (1) Zboralski, D. Glas. Ann 80 (3) 96-108, 1956 (in German)
- (2) Lotz, R., 'Wheel-Rail Noise: A Progress Report;
U.S. Department of Transportation. Mass., U.S.A. (1974)
- (3) Ver, I.R., 'Monthly Technical Reports'
Bolt, Beranek and Newman, Inc., 1973-74
DOT-TSC-644
- (4) Zboralski, Glas Ann 80 (3)
Page 96-108 (1956) (in German)
- (5) Jenkin, H.H., 'Railway Engr. J.' page 2-26 (Jan. 1964)
- (6) Naake, H., 'Acustica 3' page 139-147, (1953) (in German)

Secondary Sources

Impact noise also emits when railcars run over jointed rails, over special trackwork such as crossovers and turnouts, or when wheels have flat spots. The typical duration of an impulsive sound is 100 milliseconds.

Discrete runway surface discontinuities such as: vertical joint mismatch, angular mismatch in dipped joints under load and wheel flats contribute to impulse formed noise waveforms.

Theory⁽¹⁾ states the acoustic energy per impact is proportional to the square of the relative velocity between colliding points an instant before impact. For a wheel of radius R , train speed V and a small upward step h , yields $p^2 \propto \frac{V^2 h}{R}$ (2). For a downward step of a fixed size, an increase in train speed causes greater downward impact velocity set by force available (wheel weight plus supported load) to accelerate the wheel before impact. The above equation implies a 20 dB sound pressure level increase per decade of speed; this has been substantiated in 1/7-scale tests and in field tests of 14 inch wheels.

Corrugation noise is treated as successive impacts. Using experimental data, it can be shown that impact rate is a function of h , and train speed, V .⁽⁵⁾

"Models which include rail foundation stiffness and Hertzian contact stiffness as well as rail parameters, wheel and primary suspension parameters, give a more detailed view of impact. For dipped joints, the models predict a sharp first force peak of about .001 seconds duration governed by Hertzian stiffness, followed by a second pulse of about .015 second duration governed by unsprung wheel mass, rail mass and roadbed stiffness. Test data supports this."^(7,4)

Noise radiation from jointed rail is more localized to the excitation source than for continuous welded railroads (CWR). Above 1 KHz the propagation loss at joints become significant. As an example, the joint attenuation of 22 dB at 2.4 KHz equals the propagation loss for 230 ft. (70m) of CWR.⁽⁵⁾ See Figure 4.

Control of Impact Noise

- (1) reduce surface discontinuities and roughness by using CWR, by grinding rails and truing wheels regularly.
- (2) reduce unsprung weight by using:
 - (a) aluminum wheel hubs
 - (b) resilient materials between rim and hub, or both.

Possible Future Application

- (1) increase contact resilience between wheel and rail (i.e. rubber-like covering for wheels or rails)
- (2) reduction of sound radiating surface
- (3) reduction of forced axial rim vibration.

REFERENCES

B1 - IMPACT/IMPULSE NOISE

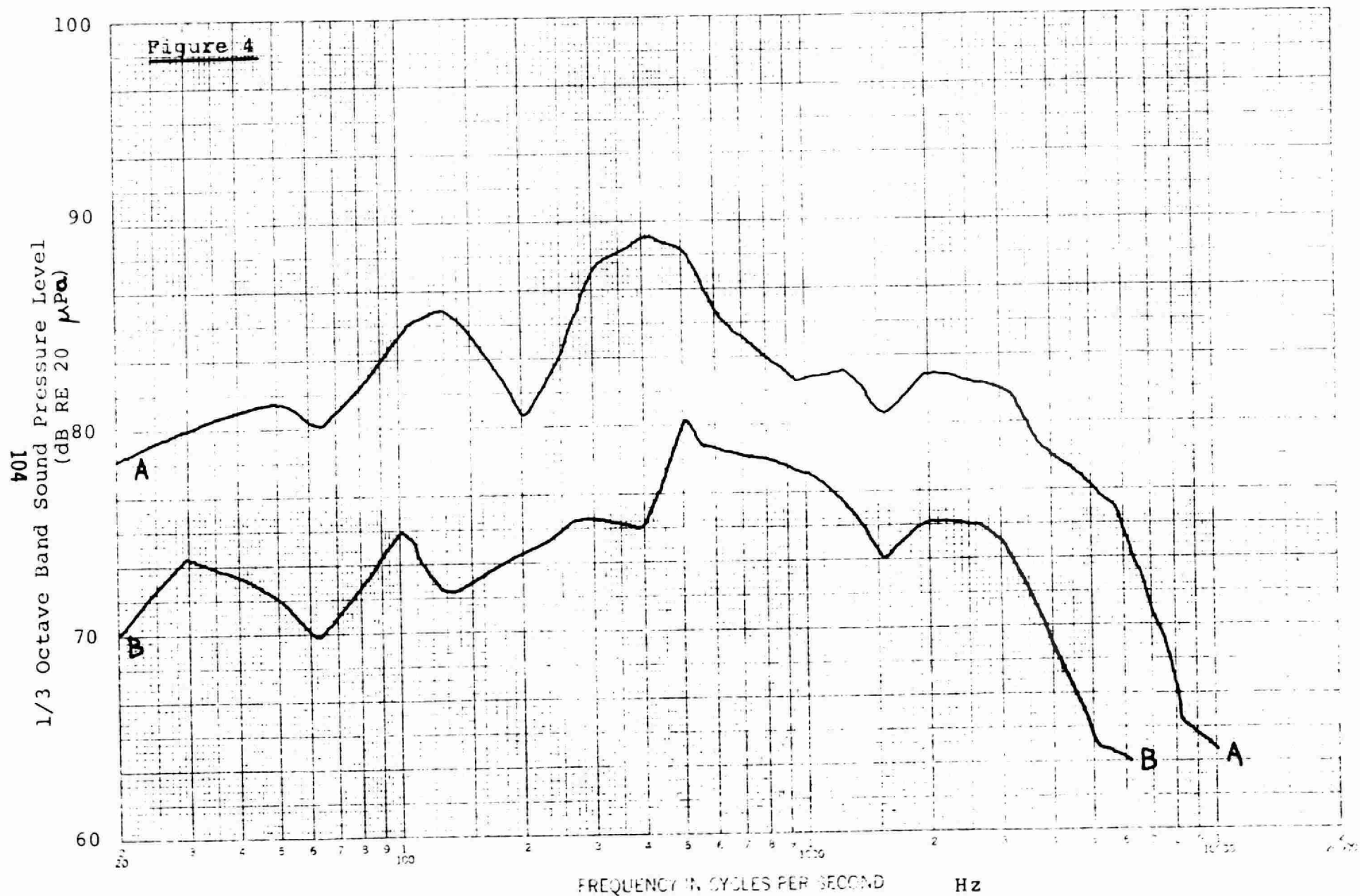
- (1) Zboralski, D. Glas. Ann 80 (3) 96-108, 1956 (in German)
- (2) Lotz, R., 'Wheel-Rail Noise: A Progress Report'
U.S. Department of Transportation. Mass., U.S.A. (1974)
- (3) Ver, I.R., 'Monthly Technical Reports'
Bolt, Beranek and Newman, Inc., 1973-74
DOT-TSC-644
- (4) Jenkin, H.H., 'Railway Engr. J.' page 2-26 (Jan. 1964)
- (5) Naake, H., 'Acustica 3' page 139-147, (1953) (in German)
- (6) J.W. Swing and D.B. Pies, 'Wyle Lab Report', WCR 73-5
(July 1973)
- (7) P.R. Nayak et al, 'U.S. Department of Transportation',
Report FRA-RT-71-64 (1970)

One-third Octave Analysis of Rolling and Impact Noise

* measurements were made for continuous welded rail (CWR)

Key A - Near Frog Crossover

Key B - 900 ft. (272m) downtrack (Ref.6)



SQUEAL/SCREECH NOISE

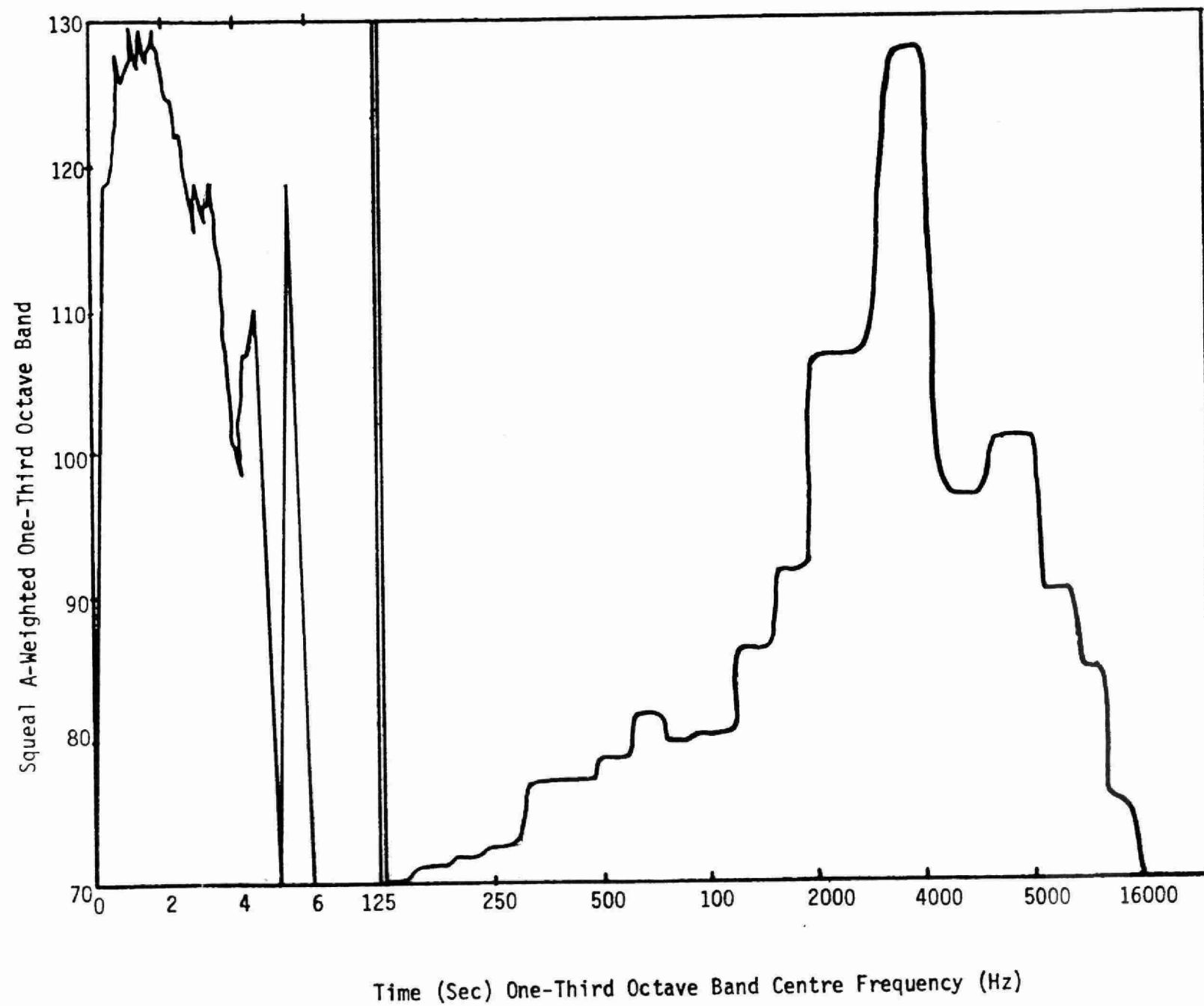
C Retarders

Retarders are mechanical devices which clamp a beam against the wheels of the cars, thereby creating a frictional force used to control the velocity of individual box cars. The retardation is controlled by varying the pressure applied to the beam, thus altering the friction force. This frictional force, in addition of controlling the amount of retardation initiates the mechanisms which create the retarder noise problem.

It has been concluded that the car wheel is the sound generator.⁽¹⁾ It is set in to vibration by the stick-slip phenomena between wheel and brake shoes called spragging. As the wheel is squeezed by the brake shoe, it tends to be gripped and then slip (somewhat like a piece of chalk clattering on a blackboard). The resulting vibration causes the wheel to produce an intense unsteady squeal occurring somewhere between 2000 and 3000 Hz⁽²⁾.

A frequency analysis of the squeal reveals a strong tonal component in the 25 Hz 1/3 octave band with a relatively weak harmonic an octave higher⁽³⁾. The distribution of peak levels of retarder squeal in Figure 5 shows a range from essentially no squeal at about 80 dB(A) to levels as high as 125 dB(A) at 50 feet⁽⁴⁾. Generally, when a car squeals the sound level is something above 100 dB, levels of 134 dB at 15 feet⁽⁵⁾ from a retarder have been recorded. Fortunately, sound decays with distance from the source hence this characteristic lends itself to a partial solution in some situations.

Fig. 5 Time History and Frequency Analysis of Retarder Squeal.



"Statistical analysis of these data show significant differences between sets of data collected on different days. The sample mean of sound levels of 23 squeals measured on the next day was 99 dB(A). Assuming that the noise levels of the squeals are normally distributed ($N(0,1)$) there is 90% confidence that the first sample mean came from a distribution of squeals with a mean between 102 and 112 dB(A). In conclusion, there is 90% confidence that the squeals for the two different days come from two different distributions and that the squeal generating process was modified from one day to the next by other variables which affect squeal noise".⁽⁷⁾ See Fig. 6 and 7.

A number of studies have been conducted in attempts to define the parameters affecting retarder screech (9, 10, 11). The significant factors are: car weight, car speed, wheel construction, presence of lubricant on the retarder shoes, condition of wheels and retarders. To date, the interaction of these variables is not sufficiently understood to allow formulation of suitable mathematical models.

"It might be expected that the level of retarder squeal depends upon car weight. However, reported data⁽¹²⁾ plotted in Figure 8 shows no correlation with car weight distribution". This is a contradictory statement to the above paragraph.

Refer to the 'Wabco Report' for their findings concerning the factors effecting retarder noise. Assuming all other sources of squeal/screech noise of secondary importance, Table 1 summarizes their affect.

Fig. 6 Retarder Squeal Amplitude Distribution

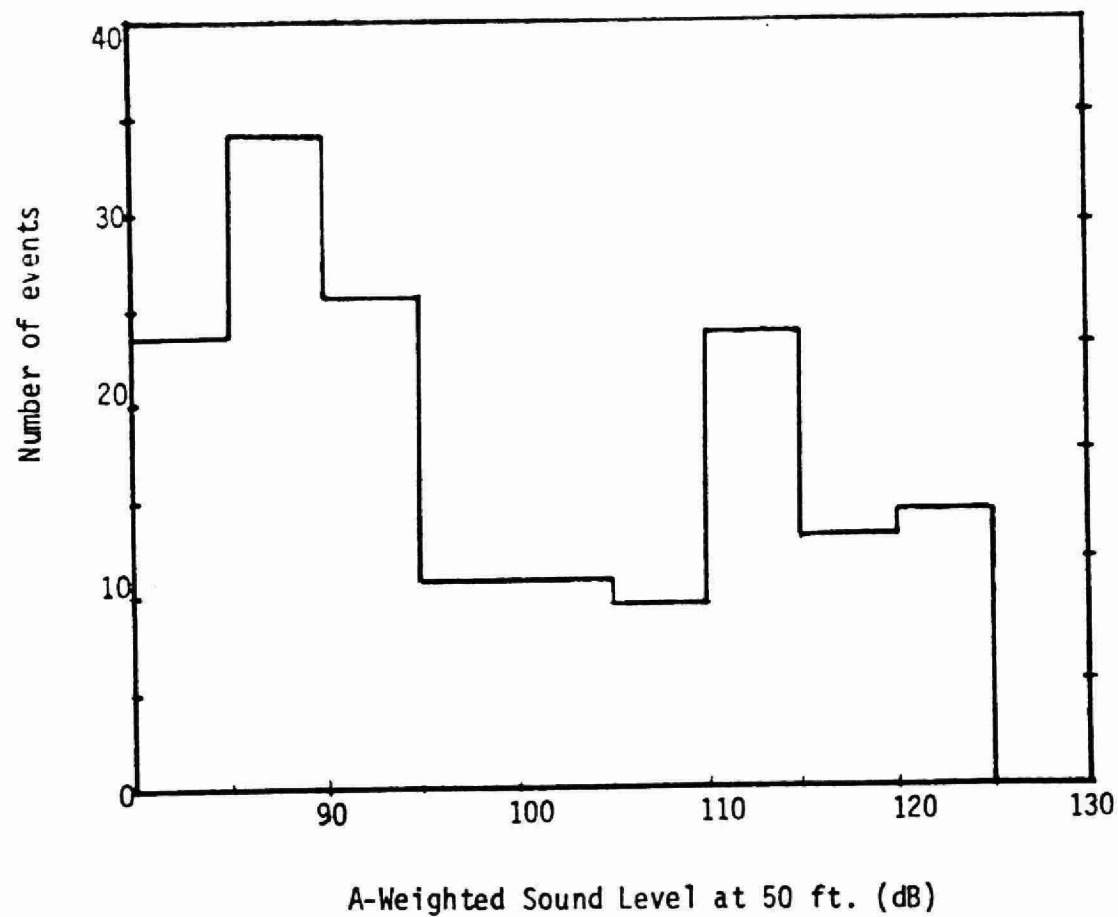


Fig. 8 Retarder Sound Level vs. Car Weight

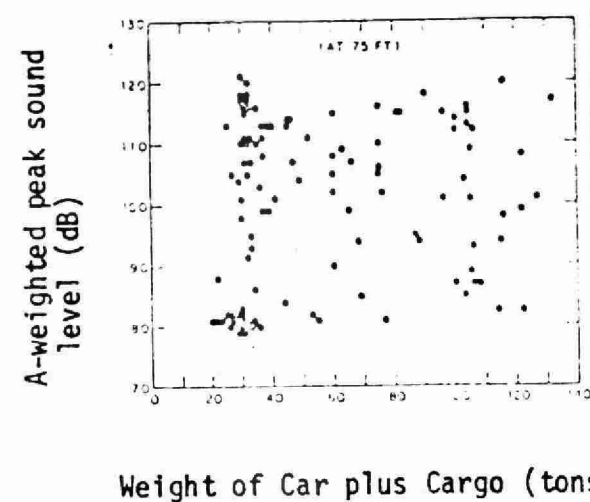


Fig. 7 Distribution of A-weighted noise levels emitted from master retarder measured 30 m. from the retarder

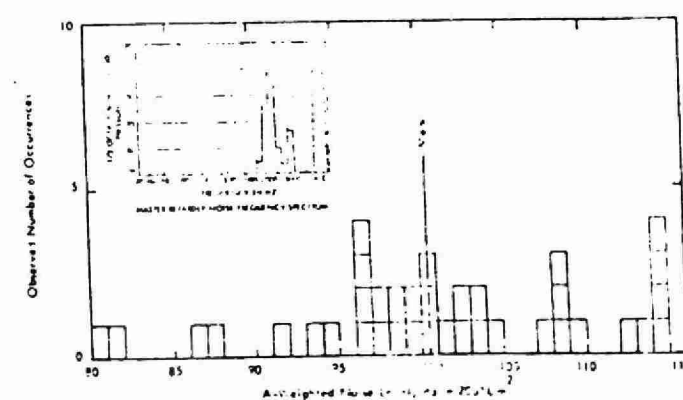


Table 1: Variables Affecting Freight Car Wheel/
Rail Noise Emissions

Variable	Increase in A-weighted Noise Level	Comment
1. Jointed rails (vs. Welded)	4 to 8 dB(A)	Generally no correction for main line tracks; assign higher value to low speed classified track.
2. Presence of Grade Crossings and Frogs	6 to 8 dB(A)	
3. Wheel Irregularities - Flat Spots or Built-up Tread	to 15 dB(A)	
4. Passage Over Bridgework (a) Light Steel Structure (b) Heavy Steel Structure (c) Concrete Structure	to 30 dB(A) to 15 dB(A) 0 to 12 dB(A)	Use lower range of corrections for heavier structures
5. Short Radius Curves (a) Less than 180 meters (600 ft.) Radius (b) 180 to 275 meters (900 ft.) Radius	15 to 25 dB(A) 5 to 15 dB(A)	Random occurrence of wheel squeal

REFERENCES

- (1) Mr. Francis Kirschner, 'New Developments in the Control of Railway Wheel Screech Noise'
1972, International Noise Control Engineering Conference,
Washington, D.C.
- (2) Bender, E.K. & Ely, P.J., 'Characterization and Control of Railroad Noise'
Bolt Beranek and Newman Inc., Cambridge, Mass. (Oct. 1974)
- (5) Karow, R., 'Noise Reduction in Classification Yards'
An American-Standard Company, P.A., U.S.A., 1973
Bulletin 308, A-75-100-1 p. 372.
- (7) same as #5, Page 244
- (8) same as #5
- (9) Embleton, T.F.W. & Theissen, G. 'Train Noises and Uses of Adjacent Land'
National Research Council, Ottawa, Canada 1962 p.10
- (10) Kiang, R.L. 'Retarder Noise Study'
Stanford Research Institute, SRI Report Number 1881, Jan. 1973
- (11) Close, W.H. & Atkinson, T., 'Technical Basis for Motor Carrier and Railroad Noise Regulations'
Sound and Vibration, Vol. 7 #10, Oct. 1973, p. 28-33.
- (12) Bender, E.K. & Ely, R.A., 'Noise Measurements In and Around the Missouri Pacific Centennial Yard, Fort Worth, Texas.'
BBN report no. 2648
- (13) Faulkner, M.G. 'An Investigation of Railroad Car Retarder Squeal'
University of Alberta, Edmonton, Alberta June 1977

SYNOPSIS OF WABCO REPORT

BY I. BORDIGNON

RETARDER NOISE

Objectives

- (1) Find a quick method to reduce the overall intensity of wheel squeal
- (2) Find some method or combination of methods to reduce the percentage of cars that squealed to absolute zero

Outcome

- Obj. (1)-Sound barrier designed by American Standard Research reduced sound level by 20 dB, later version reduced sound levels by 25 dB.
- Obj. (2)-Areas of Attack
- (a)-Different shoe material for retarder
 - (b)-Change in retarder arrangement
 - (c)-Change in retarder control
 - (d)-Use of lubrication

(1) DIFFERENT SHOE MATERIAL

Standard Shoe Material: Heat treated rolled steel

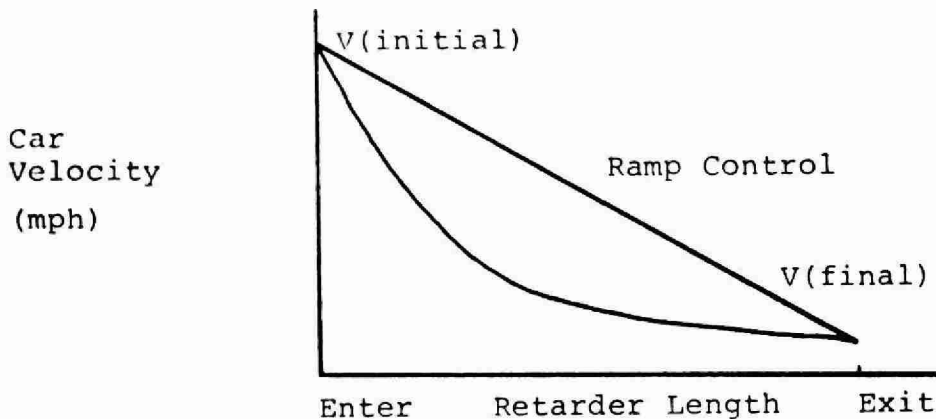
Shoe Material Tested	By	Comment
Unheat-treated Steel	Southern Pacific & CNR	-No appreciable reduction in Squeal -Shoe wear was substantially greater than standard.
Ductile Steel (casted)	Southern Pacific	-Reduced number of cars that squealed. -Short lifetime
Composition shoe material (various	3M- disbanded Johns- Manville	-None possessed sufficient mech. strength to withstand the forces encountered in retarder
'Cobra" (R) Composition material	Johns- Manville	-Lasted 86 cars.

(2) CHANGE IN RETARDER ARRANGEMENT

- observed that the buildup of vibration to produce squealing seemed to require some finite distance varying from 10 to 30 feet of retarder length.
- Retarder was rebuilt with alternating gaps between the entering and leaving beams (shoes) every 3 cylinders to create an interrupted retarder.
- This did reduce the number of cars that squealed, (no figure).

(3) CHANGE IN RETARDER CONTROL

- Retarder noise (squeal) is a function of pressure applied to wheels. (Energy imparted from retarder to wheel).
- A control circuit was designed to provide retarder control that brings a car down to a desired velocity at a uniform rate of deceleration over the complete retarder length rather than the standard approach which retards a car at the maximum rate until it is down to desired speed and then controls the car at that speed throughout the remainder of the retarder length.

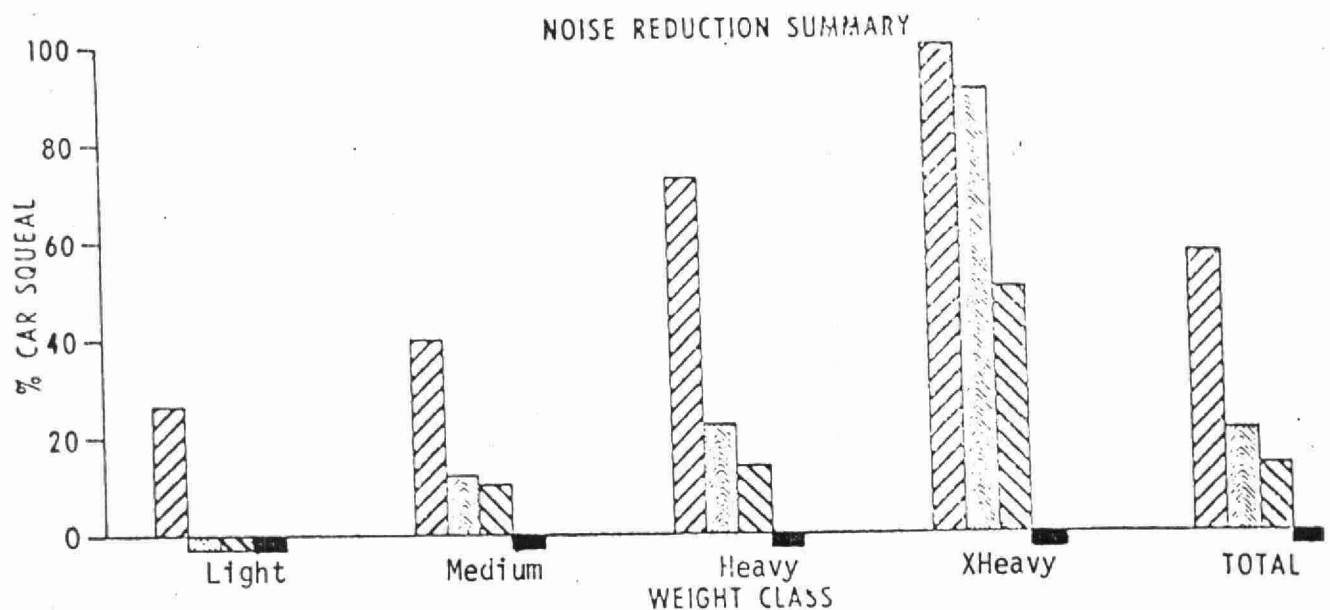


- Without ramp control, most of the retardation occurs in the first half of the retarders.
- This also resulted in greater shoe wear and stresses on the retarder.
- This method proved to have a 50% reduction in the number of heavy cars that squealed and even a greater reduction with medium weight cars (no figure given).
- There was no squeal with light cars.

(4) USE OF LUBRICATION

- Series of nozzles on a header pipe running down both sides of each rail with a steel trough below the rail to collect the run-off.
- Water soluable oil in 10% solution is sprayed on all wheels as they pass.
- Noise was reduced (no figures given).
- Results (combining the 4 methods)

NOISE REDUCTION SUMMARY



▨ = STANDARD

▩ = D.I. SHOES INT. BEAMS

▨ = D.I. SHOES INT. BEAMS RAMP CONTROL

■ = D.I. SHOES INT. BEAMS RAMP CONTROL LUBRICATION

*Conditions

- Ductile iron shoes used on inside beam with tapered entering and leaving beams installed at every 3rd. cylinder.
- add on other methods for direct comparison.

TABLE 1
SUMMARY OF TESTS

	Light	Medium	Heavy	HX	Totals
TEST CONTROL RETARDERS #2/3 STANDARD SHOES, STANDARD BEAM ARRANGEMENT.	27% of 70	27.5% of 40	72.6% of 73	100% of 16	57.6% of 196
TEST RETARDER #1 DUCTILE SHOES	0% of 22	12% of 39	22.3% of 67	90.9% of 11	20.8% of 139
PLUS RANGE CONTROL	0% of 16	10.2% of 25	14.2% of 42	50% of 8	14.2% of 91
PLUS LUBRICATION	0% of 2	0% of 14	0% of 18	0% of 1	0% of 35

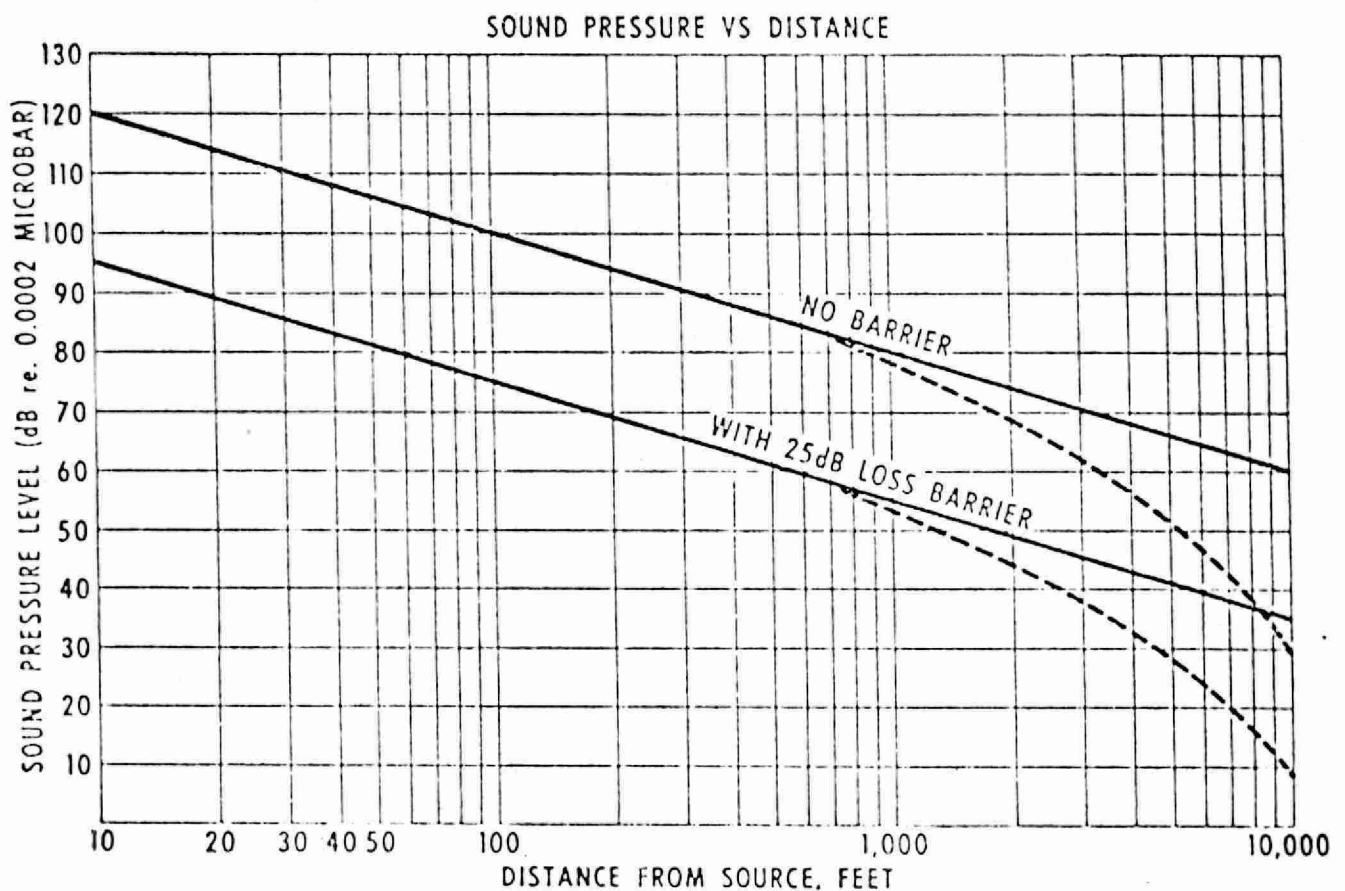
Percentage of Uncontrolled Cars

SUMMARY

- (1) The result of all noise reducing arrangements in combination produced zero squealers (see Table 1)
- (2) Regardless of which device or modification was in use, once a wheel began to squeal it squealed just as loudly.
- (3) No guarantees that these approaches in combination will eliminate all squealers. (due to -- different yard characteristics
-- retarder pressure
-- different climatic conditions
-however, these approaches will reduce the number of squealers.
- (4) Use of noise barrier to take the top 25 dB off any noise that exists. See Figure below.

Drawbacks

- (1) Ductile shoes have approximately the same amount of retardation as the standard heat treated rolled shoes, but the life of the ductile shoes when installed on inside beam is reduced by about 2/3 (1/3 life of standard shoes).
- (2) Interrupted beam approach reduces retarder rating by 12%.
- (3) Lubrication reduces retarder rating by about 25%. Also there is the additional cost of spray equipment and oil and oil recovery problems.



GENERAL RAILWAY SIGNAL COMPANY



A UNIT OF GENERAL SIGNAL

BOX 600 ROCHESTER NEW YORK 14602 716 436-2020

TELEX 978317

Ministry of the Environment

JULY 18 1977 REC'D

NOISE POLLUTION CONTROL SECTION

In response please refer to:

File: 122.5 Y&T

Retarder Noise Suppression

July 14, 1977

Mr. John Manuel
Environment Ontario
Noise Control Section
135 St. Clair Avenue, West
Toronto, Ontario M4V-1P5

Dear Mr. Manuel:

REFERENCE: The May, 1977 Meeting concerning Retarder
Noise and your telephone request on July 7,
1977.

Before the installation of the Northtown Yard at Minneapolis,
Minnesota, the Burlington Northern, Inc. made a number of
studies which they may be willing to share with you. Contact
Mr. Roger Lehrke, Regional Signal Engineer, BN Building,
176 East 5th Street, St. Paul, Minnesota, 55101.

I have enclosed the following from our files:

- A. GRS paper "Retarder Noise Abatement" by
Mr. D. E. Turner presented at the C&S
Section AAR, October 1, 1973.
- B. BN paper "Northtown Yard" by Mr. M. B.
Walker presented to the C&S Section AAR,
September 15, through 17, 1975.
- C. BN paper "The Quiet One" by Mr. M. B.
Walker presented to the March 23, through
24, 1976, Technical Conference of the
AREA.

July 14, 1977

- D. Copy of article "BN Reduces Noise at Northtown Yard" from the Signalman's Journal, March, 1977.
- E. Copy of article "Noise Abatement for Retarder Yards" from Railway Age, June 28, 1971.
- F. Copy of article "BN Studies Retarder Noise Abatement" from Railway System Controls, November, 1972.
- G. Excerpts from US Environment Protection Agency Report EPA 550/9-76-005 dated December, 1975 titled "Background Document for Railroad Noise Emission Standards".
- H. Letter from Industrial Acoustics Company, Inc. to Mr. David Feller on IAC Railroad Noise Barrier Systems dated July 29, 1975.
- I. GRS Publication "BN's Northtown Yard, Nearing Completion, Is Already Working" #1546C dated May, 1975.
- J. Various articles.
- K. GRS paper "The Mechanics of the Car Retarder" by NCL Brown presented to the Railroad Division of the ASME dated September 17, 1936.
- L. Various Clearance Diagrams.

I hope the above will serve your requirements.

Very truly yours,



E. J. Sexton
Product Engineer

EJS:l
Enclosures
cc: M. Sluis
S. Latone
Montreal Office



National Research Council
Canada

Division of Mechanical
Engineering

Conseil national de recherches
Canada

Division de génie
mécanique

Ministry of the Environment

JULY 18 1977 REC'D

NOISE POLLUTION CONTROL SECTION

File Reference

3500-5-3

July 14, 1977.

Mr. John Manuel,
Pollution Control Branch,
135 St. Claire Avenue West,
Toronto, Ontario.
M4V 1P5

Dear Mr. Manuel,

RE: Railway Classification Yard Noise

I thank you for the good meeting we had in May 1977 on classification yard noise problems. After much discussion by the participants in the meeting, it came out rather clearly that the retarder noise control by external means such as by erecting acoustic barriers, sheds and the like are not promising solutions and attempts should be made to control the noise at the source itself.

Although several alternative ways of controlling the noise from the friction retarders were discussed, I do not recall if there was any mention made of using the Dowty retarders. I gather that these retarders dissipate energy hydraulically in a capsule containing a piston and a cylinder as opposed to friction in the conventional retarders. These units are bolted at strategic intervals to the rails and as the car moves along the rails, the flange of each wheel compresses the piston dissipating the energy hydraulically through a relief valve. Incidentally, this method could be used to accelerate the cars as well, by combining with pneumatic boosters to propel the slow moving cars.

The manufacturers of this equipment claim several advantages to this method over friction retarders, economies in design and yard construction, installation and operation, and superior in its performance, and noise being one of them. I gather these units are in operation in the marshalling yards of several countries including the U.K., Australia, Switzerland and Japan. Their brochure quotes a noise level of 55 dBA at 1500 ft distance at maximum train speeds over the retarders. Under normal operating conditions, the speeds are below the maximum operating speed with still lower noise levels. These levels appear to be much lower than the 100 dBA at 150 ft distance from the retarders for the Edmonton yards quoted by Dr. Faulkner.

I gather Mr. N. Hanks, Assistant Chief of Transportation - Planning, of Canadian National Railways has visited the Dowty equipped yards in the U.K. and has recently ordered a number of retarders for winter trials in Montréal. I wonder if C.P. have given any thought on equipping any of their yards with the Dowty equipment?

Yours sincerely,



G. Krishnappa,
Engine Laboratory.

c.c. Dr. D.C. MacPhail
Mr. E.H. Dudgeon
Dr. T.W.F. Embleton
Mr. C.A.M. Smith



Ontario

ice of the
nister

Ministry of
Transportation &
Communications

Queen's Park
Toronto Ontario

May 4, 1977

Honourable Otto Lang,
Ministry of Transport,
Place de Ville,
Ottawa, Ontario.



Dear Mr. Lang,

I have recently had contacts from numicipal officials and concerned citizens in Scarborough and Oakville with respect to noise problems associated with railway yard operations in urban areas.

The concern seems to be centred on the fact that government or governmental agencies have little or no authority to act on behalf of the local citizens particularly with respect to noise issues.

I would appreciate your comments as it is a subject I think we should discuss further at a future meeting.

With kindest regards, I remain

Yours sincerely,

ORIGINAL SIGNED BY
THE HONOURABLE JAMES SNOW, M.P.P.

James Snow,
Minister.





Provincial
Secretary for
Social
Development

Parliament Buildings
North Wing
Queen's Park
Toronto Ontario

May 11, 1977



Mr. Bill Belfontaine,
Alderman, Ward 1,
The Corporation of the Borough
of Scarborough,
150 Borough Drive,
Scarborough, Ontario.
M1P 4N7

Dear Bill:

I regret the delay in replying to your letter of March 11, 1977 concerning increased noise from the C.N.R. yard expansion in Scarborough, and municipal planning activities associated with railways.

It would seem that the C.N.R. can expand their operations without obtaining approval from any Municipal, Provincial, or Federal agency, including the C.T.C.

I can assure you that the Provincial Government shares the concerns of the municipalities in this regard. The Honourable James Snow, Minister of Transportation, will soon be contacting the Honourable Otto Lang, Minister of Transport, to convey to him our concerns. Hopefully some way can be found to improve relationships with railways.

Kindest regards,

Sincerely,

Margaret Birch,
Provincial Secretary
for Social Development.

cc: The Honourable George Kerr

Bill Belfontaine
Alderman, Ward 1

Scarborough

The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ont. M1P 4N7
Telephone (416) 438-7275

MAR 17 1977

51
MUNICIPAL OFFICE



March 11, 1977.

Hon. Thomas Wells, M.P.P.,
Scarborough North,
22nd Floor, Mowat Block,
900 Bay Street,
Toronto, Ontario.

Dear Tom:

RE: Railway System

Attached is a copy of a letter we recently received from the Secretary of the Railway Transport Committee.

It is in response to a resolution from Scarborough Council, which we had hoped would begin a dialogue with the C.T.C. and encourage far better co-operation from the railways. (See Page 6, Section "C")

I am very perturbed at the cavalier attitude displayed in the letter toward municipal planning problems caused by railways.

Perhaps you would like to share our concern, which is also the concern of Council, and contact the C.T.C. personally to ask them to consider a change of attitude toward municipalities.

We find the reply from the Secretary of the C.T.C. very abrasive and uncalled for. I hope you will see it that way too.

Sincerely,

A handwritten signature in cursive script that reads "Bill Belfontaine".

Bill Belfontaine,
Alderman, Ward 1.

BB/sh
Attach.

28-1

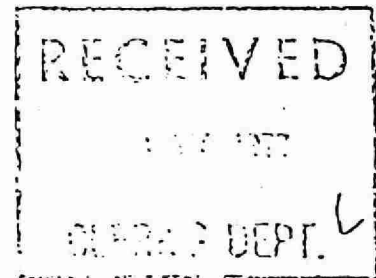
275 Slater Street
Ottawa, Ontario
K1A 0N9

February 14, 1977
YOUR FILE No. 1.831-1
Votre dossier

OUR FILE No. 49787.1
Notre dossier

Canadian TRANSPORT
Commission

Commission canadienne
des TRANSPORTS



Mr. J.J. Poots
Clerk
Borough of Scarborough
150 Borough Drive
Scarborough, Ontario
M1P 4N7

Dear Mr. Poots:

This is in reference to your letter of August 18, 1976 to the District Office of the Railway Transport Committee in Toronto in the matter of the expansion of the Canadian National Railway facilities to the General Motors plant located in the Eglinton East area of Scarborough.

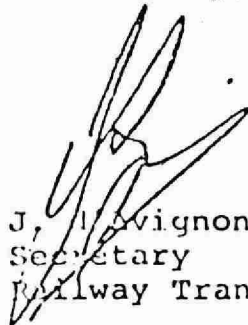
Receipt of a copy of an extract of Clause 3 of Report No. 15 is acknowledged. Item c, page 3 of the extract is noted, namely, that the Council of Scarborough be advised of any plans that the Canadian Transport Commission might have with regard to an analysis of the impact of rolling stock in urban areas.

Canadian National Railways is under no obligation to obtain authority from the Commission to construct additional tracks on its own property at Scarborough. Consequently, no public hearing is required before work is undertaken. Moreover, the law does not presently require federally chartered railways to act in conformity with municipal zoning regulations.

...2

The Committee has not made any overall study that could be described as an "analysis of the impact of rolling stock in urban areas". Nor has the Committee established any "noise regulations". Unfortunately, a railway operation, by its nature, is sometimes noisy. Where it can be shown that a railway company is operating in a way that gives rise to unnecessary noise, the Commission would be prepared to investigate such an operation and take whatever measures are afforded by law.

Yours truly,



J. M. Vignon
Secretary
Railway Transport Committee

John Wimbs
Alderman Ward 11

Scarborough

The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ont. M1P 4N7
Telephone (416) 438-7275



September 30, 1976.



Mr. George A. Kerr,
Minister of the Environment,
Province of Ontario,
135 St. Clair Avenue West,
Toronto, Ontario.
M4V 1P4

Dear Mr. Kerr:

Thank you very much for your letter of September 7th regarding the noise problem from the Agincourt Marshalling Yards.

I have the pleasure of enclosing copies of material on my file and would be pleased if your staff would peruse them as you suggest.

Looking forward to hearing from you again.

Sincerely,

A handwritten signature in cursive script that reads "John Wimbs".

John Wimbs,
Alderman, Ward 11.

JW/ms
encl.



Joe DeKort
Alderman Ward 12

RECEIVED

APR 25 1976

Scarborough

ALDERMENS' OFFICE

The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ont M1P 4N7
Telephone (416) 438-7275



April 23, 1976.

TO: Alderman Jack Goodlad) Special Committee on Agincourt
✓ Alderman John Wimbs) Marshalling Yards Noise Problem
Mr. Phil Allen, C.D. Farquharson Community Association,
All Community Associations.

Attached please find a copy of a recent letter sent to me from
Hon. Martin O'Connell regarding the marshalling yards.

This letter indicates that a report will be before us in the near
future.

Sincerely,

A large, stylized handwritten signature, likely of Joe DeKort, consisting of a large loop and a trailing flourish.

Joe DeKort,
Alderman, Ward 12.

/sh

attach.

April 23, 1976

PLANNING

EXECUTIVE OFFICES

Note

Mr. D. F. Easton,
Commissioner

Marshalling Yards

Attached please find a copy of a recent letter sent to me from
Hon. Martin O'Connell regarding the marshalling yards.

He poses a question whether the Borough had zoned the land resi-
dential prior to the agreement to accept the marshalling yards.

Will you please reply to this question?

Joe DeKort,
Alderman, Ward 12.

/gh

cc: ✓Alderman John Limbs,
Alderman Jack Goodlad.

RECEIVED

APR 28 1976

ALDERMAN'S OFFICE

Ottawa K1A 6A6
April 7, 1976

Mr. Joe DeKort
Alderman, Ward 12
The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ontario
M1P 4K7

Dear Joe:

Thank you for your letter of March 25.

Re the CPR: The report is complete and is in the hands of the CTC. I have been in touch with the CTC about two weeks ago and was given a brief idea of what was in it. A number of options were discussed; for example, fences, liquid on the tracks, etc. This is now being studied at CTC. The CPR suggested that the National Research Council be brought in on the costs of doing further studies and for experimental development of noise-reducing equipment. I will get back to them again to see when they are going to release the report and urge them to get on with it.

Incidentally, could you find out whether the Borough had zoned the land residential prior to the agreement to accept the marshalling yards, or did it zone it residential subsequent to that decision. This would be useful to know, particularly for the land that is now being built on that is close to the tracks. Do you think it is wise to continue releasing land for houses until this problem is solved? Should any of the area be rezoned back to commercial and industrial that is now residential? I realize this doesn't affect the homes that are already there and that we have to solve the noise problem, but I would just be concerned lest we were making it worse by going ahead with development that is bound to get into difficulty later on unless a successful solution to this problem can be found.

Mr. Joe DeKort

2

April 7, 1976

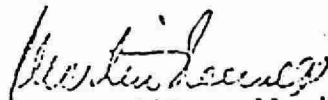
It is somewhat the same on the Bluffs at the foot of Livingston where the town houses are surely endangered by the rapid rate of current erosion. The public will be called upon to pay very high costs of protecting this private property which probably should not have been there in the first place.

With respect to the railway yards, it seems to me that one problem is the whine from the locomotives when they are in low gear. Surely this can be corrected by some other form of locomotive or gearing arrangements. The other problem are the retarders. Surely we can correct that, but it is going to take money and continuing research to find the correct answers. The company has experimented with different kinds of brakes and with different kinds of liquid on the tracks. Some have certain success in noise reduction and others bring different problems with them; for example, pollution of the ground. In any case, I will be pushing to have the report made available to the Borough as quickly as possible.

I will keep on top of the CPR thing because I know how important it is to you.

With all best wishes.

Yours sincerely,



Martin O'Connell, M.P.
Scarborough East

Joe DeKort
Alderman Ward 12

Scarborough

The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ont. M1P 4N7
Telephone (416) 438-7275

February 24, 1976.



TO: Alderman Jack Goodlad) Special Committee on Agincourt
Alderman John Wimbs) Marshalling Yards Noise Problem

Mr. Phil Allen, Chairman, Area Development Committee,
C.D. Farquharson Community Association
Mr. Bob Sobisz, President, C.D. Farquharson Community Assoc.
Mr. Paul Nellis, President, White Haven Community Association
Mr. Dave Penny, President, Malvern Residence Association
Mrs. S. Churchmuch, President, Iroquois Community Association
Mr. Dave Gooderham, President, Brimley Forest Community Assoc.

As most of you are aware, the matter regarding the noise at the railway marshalling yards has been a long standing problem.

As some of you may not be aware of the background material of the past year, I have enclosed a copy of the material that the Honorable Martin O'Connell, M.P., Scarborough East, sent to me recently. This information represents a good summary to date.

I gather from the Works & Transportation meeting last week, the C.P.R. is responding to the C.T.C.'s request for a report.

Sincerely,

Joe DeKort,
Alderman, Ward 12.

/sh

Enclosure.

HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

Ottawa K1A 0A6
February 17, 1976

Mr. Joe DeKort
Alderman
The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ontario
M1P 4N7

Dear Joe:

I am enclosing my complete file on the CPR marshalling yards for your information.

I want to assure you that I have been watching and pressuring the Department and will continue to do so until we get some satisfaction.

Yours sincerely,



Martin O'Connell, M.P.
Scarborough East

RECEIVED

FEB 20 1976

ALDERMENS' OFFICE

CPR Marshalling Yards and Noise Level

July 17/75	Letter to Hon. Marc Lalonde, Health & Welfare
"	" Mr. J. H. Green, Railway Transport Commission
"	" Hon. E. J. Benson, President, CTC
"	" Mr. Joe DeKort
July 16/75	Conversation with Mr. J. H. Green, Railway Transport Commission
Aug 5/75	Acknowledgement from Health and Welfare
Aug. 21/75	Letter from Hon. E. J. Benson enclosing minutes of a June 17/75 meeting between representatives of the Railway and members of the Subcommittee of the Building, Fire & Legislation Committee of the Borough of Scarborough
Sept. 9/75	Letter from Hon. Marc Lalonde
Sept. 11/75	Letter to Mr. Joe DeKort
Sept. 29/75	Letter to Hon. Jeanne Sauvé
"	" Mr. Joe DeKort
Oct. 3/75	Acknowledgment from Environment Canada
Oct. 27/75	Conversation with Mr. F. Macenko, Chief, Noise Control Division, Department of Environment
Oct. 29/75	Letter to Mr. Macenko
Dec. 8/75	Letter from Mr. Joe DeKort with recommendations
Dec. 31/75	Spoke to Mr. Greene, CTC. CTC still waiting for a final report from CP. Mr. Greene said he would look into it and get back.
Jan. 13/76	Letter from Hon. Roméo Leblanc
Jan. 21/76	Spoke with Mr. Greene, CTC
Feb. 13/76	Spoke with Mr. Greene, CTC
Feb. 17/76	Spoke with Mr. Greene, CTC, who is sending a report submitted to Borough of Scarborough by Scarborough Planning & Works (Told him we have a copy but he feels he'd like to send us what they have.) ... CP tells him their report should be done soon... Greene meeting CP's solicitor today
Feb. 17/76	Letter to Hon. Jean Marchand
Feb. 17/76	Letter to Mr. Joe DeKort

HOUSE OF COMMONS
CHAMBRE DES COMMUNES
CANADA

Ottawa K1A 0A6
February 17, 1976

The Honourable Jean Marchand
Minister of Environment
Room 258 CB
House of Commons
Ottawa

Dear Mr. Minister:

I am forwarding a copy of a letter dated January 13, 1976, from the Honourable Roméo Leblanc concerning the noise level at the CPR marshalling yards in Scarborough.

I am most interested in any reports or preliminary studies that officials of your Department may have begun concerning the noise level and its impact on the surrounding community.

Could I impose upon you to take a personal interest in this and let me know what your officials have done.

Thank you for your assistance.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East



Minister
Environment Canada

Ministre
Environnement Canada

Ottawa, Ontario.

K1A 0H3

January 13, 1976

The Honourable Martin O'Connell, P.C., M.P.,
House of Commons,
Ottawa, Ontario.
K1A 0A6

Dear Mr. O'Connell:

Subject: CPR Marshalling Yards and
Noise Level

In my new portfolio as Acting Minister of the Environment, I am replying to your letter of September 29, 1975, addressed to the Honourable Jeanne Sauvé.

Environment Canada shares your concern regarding noise problems associated with railway yards. We have contacted the Ministry of Transport and plan to work with them in implementing noise control measures where needed.

With regard to the noise emanating from the CPR marshalling yards in Scarborough, my officials will be making measurements and performing other studies to determine the sources of the noise and the extent of its impact on the surrounding community. Recommendations for remedial measures that should be instituted will be made to the Ministry of Transport, with a request that these be initiated as soon as possible.

Thank you for writing.

Yours sincerely,

Roméo LeBlanc,
Acting Minister.

Joe DeKort
Alderman Ward 12

Scarborough

The Corporation of
The Borough of Scarborough
150 Borough Drive
Scarborough, Ont. M1P 4N7
Telephone (416) 496-7275



December 8, 1975

Hon. Martin O'Connell, M.P.,
Scarborough East,
House of Commons,
Ottawa, K1A 0A5

Dear Martin,

Re: Railway Marshalling Yards

Our staff has made a recommendation that certainly meets with my concurrence.

We expect word soon from the C.T.C.

Sincerely,

Joe DeKort,
Alderman, Ward 12

JDK/plk
Enclosure

Sent for Phil Allen, Chairman, Area Development Ctee. C. D. Farquharson,
Sobisz, President, C.G. Farquharson CA.
Martin O'Connell, M.P. Scarborough East

December 8, 1975

Re: Railway Marshalling Yards

Our staff has made a recommendation that certainly meets with my concurrence.

We expect word soon from the C.T.C.

Sincerely,

Joe DeKort,
Alderman, Ward 12

JDK/plk
Enclosure

BOROUGH OF SCARBOROUGH

Clock's Department

Recommendation embodied in Report No. 2 of the Building, Fire & Legislation Committee adopted as amended by Council at its meeting held on February 16, 1976.

3. Establishment of Special Committee re Noise and Diesel Exhaust from Agingcourt Marshalling Yard

COMMITTEE RECOMMENDS that a Special Committee, comprised of the Chairman of the Building, Fire and Legislation Committee, Alderman J. Winbs and Alderman J. DeKort, be established to discuss the matter of the noise and diesel exhaust from the Agingcourt Marshalling Yard.

BOARD OF CONTROL RECOMMENDS THAT THE SPECIAL COMMITTEE BE REQUIRED TO REPORT TO COUNCIL ON THIS MATTER BY APRIL 30, 1976.

THE FOREGOING CLAUSE WAS AMENDED AS FOLLOWS:

1. Strike out the Board of Control recommendation; and
2. Adopt the Committee recommendation.

Star 27/1/76

Train noise, fumes at yard get study

Noise and diesel exhaust from the Canadian Pacific Railways marshalling yard in Agincourt will be investigated by a special sub-committee of Scarborough Council.

The sub-committee, to be composed of Ward 4 Alderman Jack Goodlad, Ward 11 Alderman John Wimbs, and Ward 12 Alderman Joe DeKort, will report its findings to the building, fire and legislation committee.

Last July, Scarborough Council asked CP Rail to study its marshalling yard district.

Besides noise and fumes, the study was to consider whether the yard could be enclosed and whether night activity could be rescheduled for the daylight hours.

But a report to the building committee by Don Easton, planning commissioner, and Roger Brown, works commissioner, said it is probably too late for the borough to do anything.

Wimbs said CP Rail should be asked to eliminate the noise in the yard itself.

"For people south of Sheppard Ave.," he said, "nothing much can be done unless it is done in the yards themselves."

CP Rail will be asked to respond to council's request to consider a study before the next meeting of the committee.

February 6, 1976

Mr. A. R. Schmidt,
21 Castlemere Crescent,
Agincourt, Ontario.
M1W 1K4

Dear Mr. Schmidt,

Thank you very much indeed for your most informative letter of January 29, regarding the noise problems at the C.N. marshalling yards.

I have forwarded copies to all the members of the Committee, and also to the members of the Building, Fire and Legislation Committee, for their information. We will most likely be reporting to Council some time towards the end of April, and hopefully by that time we will have some solution to the problem.

Meanwhile, I appreciate very much indeed the time you have taken to write. It was a most interesting letter, and shows that you have a great knowledge of the problem. I will put you on our mailing list for the Agincourt Marshalling Yards Study, and perhaps you might like to comment as time goes on.

Sincerely,

John Wimba,
Alderman, Ward 11

JW/plk

copy: Alderman Ron Watson
Ward 10

February 6, 1976

TO: CHAIRMAN AND MEMBERS OF
THE BUILDING, FIRE & LEGISLATION COMMITTEE
and
MEMBERS OF THE SPECIAL COMMITTEE ON THE
AGINCOURT MARSHALLING YARDS NOISE PROBLEM

The attached letter, dated January 29, received from Mr. A. R. Schmidt gives information that we should discuss with the C.N. people when we next meet.

I have written to Mr. Schmidt, thanking him for his interest, and no doubt we will be commenting on this at our first meeting.

Sincerely,

John Wimbs,
Alderman, Ward 11

JW/plk

Phone call rec'd from Jim Corbin (291-6990)
27 Bellefontaine St. Jim belongs to the railway
union and says that management does not insist enough
on employees going through the proper motions when
driving the deisel locomotives. If the proper sequence
is used in operating the throttle (smoke and fuel con-
trolled by governor) then smoke can be eliminated.

Replied 1/26/76 - jw.

21 Castlemere Crescent,
Agincourt, Ontario
M1W 1K4

January 29, 1976.

Alderman John Wimbs,
Borough of Scarborough,
Civic Centre,
150 Borough Drive,
Scarborough, Ontario
M1P 4N7.

Dear Alderman Wimbs:

I have a comment and a suggestion to make about the subject of the attached clipping.

When the CN marshalling yard at Concorde was being constructed in the early 60's, it was my contention that it should be enlarged to cater also to CP's needs, in the form of a joint facility (like Union Station is). This would have allowed the economies of greater scale and the convenient interchange of freight cars between the two railways. It would also have released the West Toronto-Agincourt line for commuting and other passenger purposes, a need which will become more and more evident as Scarborough grows to the north-east.

But the Agincourt yard is with us, I would guess for a long time to come. To make the best of the situation calls not for reduction or restriction of engine movements, in my opinion, but for change in motive power.

You will have noticed that the most continuous source of noise from the yards is a battery of three switching locomotives which pushes incoming trains over the hump at very low speed, for sorting purposes. Most of their work is done on a single stretch of line about a mile long, between Midland (approximately) and the hump itself. These engines have diesel-electric drive. Their traction motors could be as easily fed with electrical power from an overhead wire as from their present on-board diesel-driven generators. While these particular engines are not large, it is the drumming caused by their revving at slightly different speeds which causes most aggravation - remember the similar problem with the old North Star aircraft?

Necessary changes to the locomotives themselves would be minimal. They could revert to conventional operation with little trouble. The cost would be limited mainly to poles and contact wire. The TTC probably has lots to spare, from old streetcar lines.

.../

...2

The above change wouldn't silence the three or four independent switch engines which are used at the far end of the yard to retrieve strings of cars from the sorting tracks. However, that end of the yard is furthest removed from residential areas.

Nor would it eliminate noise from trains departing on the main line. However, your borough staff probably could run checks on the frequency and duration of various types of movement, their typical noise, and the living areas most impacted. I think you will find that main line trains are less than half of the problem, and in any event are a source of noise which doesn't lend itself as easily to measures confined to the site.

Yours truly,

A handwritten signature in dark ink, appearing to read 'A. R. Schmidt', with a horizontal line extending to the right.

A. R. Schmidt.

Attach.

MEMORANDUM No. 15

MEMO No. 73

DATE DEC 11 1975

TO
CHAIRMAN AND
MEMBERS OF THE

PLANNING BOARD.

Date December 1, 1975.

Re: Agreement and Disposal Exhibit from Agincourt Marshalling Yard
Item 2, Report 13, Building, Fire and Legislation
Committee - July 14, 1975

REPORT:

The above report included agreement that "the Planning and Works Departments consider the matter of providing an effective buffer for the neighbourhoods to be developed in the area of the Marshalling Yard." The Planning Board, on August 7, 1975, directed "that the Planning Commissioner prepare a report on the feasibility of doing this study, with the Works Department to be requested for their comments."

We have considered the problem, and believe that an extensive study, by an independent consultant, at a significant cost, would not be advisable at this time. It should be pointed out that the Sub-committee of the Building, Fire and Legislation Committee did meet with representatives of C.P. Rail, and environmental problems, specifically noise, were identified and discussed. As a result of that meeting, C.P. Rail was to be asked to consider the feasibility of undertaking a study, addressing itself specifically to five problem areas. In addition to this, the Environmental Studies Co-ordinator, of the Works Department, has reported with an overview of the situation.

With this background in mind, it is quite apparent that environmental impact on existing housing is minor in comparison with that to be experienced by the housing now under construction, and which has been approved by this Municipality. It is probably too late to effectively provide buffering by land use changes, and only minor benefits can be achieved by any action of the Borough at this time.

Note

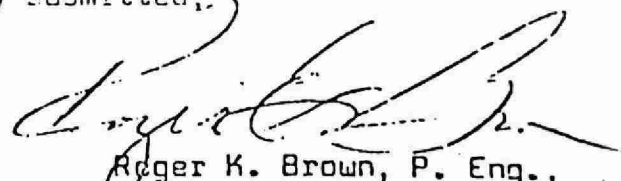
We are of the opinion that the C.P.R. should be asked to respond to our request, and that the feasibility of enclosing all or part of the humping operation should be given priority. There may very well be operating benefits which would accrue to the Railway apart from environmental considerations. In addition to this, Municipal departments having some means to control the design of industrial development, and residential buildings in this area, should be asked to take the Marshalling Yard problem into account in the development stage.

..... 2.

COMENDATION: That this report be distributed to those involved in development control in the Municipality, and that the request of Council to the Canadian Pacific Railway be followed up as soon as possible.

Respectfully submitted,


D. F. Easton,
COMMISSIONER OF PLANNING.


Roger K. Brown, P. Eng.,
COMMISSIONER OF WORKS.

Ottawa K1A 2W
October 29, 1975

Mr. F. Macenko, Chief
Noise Control Division
Department of Environment
14th Floor, Place Vincent Massey
Ottawa, Quebec

Dear Mr. Macenko:

I appreciated the opportunity to talk with you ~~with respect to~~ about the noise problem at the CPR marshalling yards in Scarborough.

As agreed, I attach my file of correspondence so that you would be aware of what has been happening at my end.

I would appreciate hearing from you whenever you have anything to say that would help me explain to the residents of the area what is happening or likely to happen.

Many thanks for your cooperation.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East

Ottawa, Ontario
K1A 0H3

OCT - 2 1975

The Honourable Martin O'Connell, P.C., M.P.
Scarborough East
House of Commons
Ottawa, Ontario
K1A 0A6

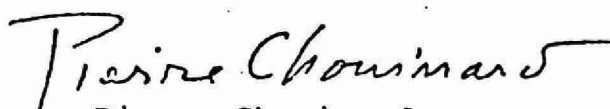
Dear Mr. O'Connell:

Subject: CPR Marshalling Yards and
Noise Level

The Honourable Jeanne Sauvé has asked me
to acknowledge with her thanks your letter of
September 29, 1975.

The Minister will be replying to you just
as soon as possible.

Yours sincerely,


Pierre Chouinard
Executive Assistant

Ottawa K1A 0A6
September 28, 1975

Mr. Joe DeKort
65 Blue berry Drive
Agincourt, Ontario

Dear Joe:

I thought you might like to have a copy of the letter which I just received from the Minister of Health and Welfare with regards to the high level of noise in the vicinity of the CPR marshalling yards at Scarborough.

I have followed his suggestion that this matter also be brought to the attention of the Minister of Environment. As soon as I have a reply from that Department, I will let you have a copy.

I am anxious to follow this matter closely and to do all I can to help out. Do let me know of any new developments on your side.

Best regards,

Martin O'Connell, M.P.
Scarborough East

Ottawa K1A 5A6
September 29, 1975

The Honourable Jeanne Sauvé
Minister of Environment
House of Commons
Ottawa

Dear Madame Minister:

This Re: CPR Marshalling Yards and Noise Levels

I attach a copy of a letter which I wrote on July 17 to the Honourable E. J. Benson, President of the Canadian Transport Commission, explaining to him the noise problem that has arisen in Scarborough as the result of the operation of the CPR marshalling yards. I also attach for your information a copy of Mr. Benson's reply of August 21, as well as a copy of the enclosures to Mr. Benson's letter.

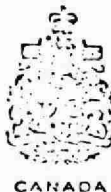
I had also approached the Minister of National Health and Welfare with this question, and it is at his suggestion that I am writing to you now as your Department, in conjunction with provincial authorities, is apparently working on noise problems associated with railway yards. You will note, from reading the attached letter, that there is a very high and penetrating whistling sound as the diesel locomotives push cars up a hump so that they will run down the other side by gravity and form new trains as a result of the marshalling operations. The high sound is either a warning whistle on the part of the locomotives to those who are down below or is the high whining sound of turbochargers as they idle as part of the whole exercise. This goes on 24 hours a day depending on the business. It keeps people awake at night. It is particularly bad in the summer when windows and doors are open, but it is bad all year round. I observed the whistle very clearly one mile from the marshalling yards and undoubtedly it penetrates for approximately two miles. It is beyond endurance. People wait for the next whistle which perhaps is only three or four minutes away in time. There is also the high squealing sound of metal on metal as the retarders go into action to slow the downhill movement of the cars in order to reduce their speed for coupling purposes. These two noises are beyond community standards.

September 29, 1975

I would very much appreciate you letting me know whether you feel you have jurisdiction in this field with respect to dealing with any other measurement of noise and its abatement. I intend to follow this matter up in some fashion to protect the community from the current noise levels. Possibly it should be done through the CTC, as well as Health and Welfare and your own Department. Anything you could do to advise me would be very much appreciated.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East



MINISTER OF NATIONAL HEALTH AND WELFARE
AND
MINISTER RESPONSIBLE FOR THE STATUS OF WOMEN

MINISTRE DE LA
SANTÉ NATIONALE ET DU BIEN-ÊTRE SOCIAL
ET
MINISTRE CHARGÉ DE LA SITUATION DE LA FEMME

OTTAWA, K1A 0K9

SEP 9 1975

The Honourable Martin O'Connell, P.C., M.P.,
House of Commons,
OTTAWA, Ontario.
K1A 0A6

Dear Mr. O'Connell:

This refers to your letter of July 17, 1975.

I appreciate your concern about the high level of noise in the vicinity of the CPR marshalling yards at Scarborough. I note that you have sent a letter regarding this matter to the Honourable E.J. Benson; may I suggest that you also inform the Honourable Jeanne Sauvé, Minister of Environment. It is my understanding that her Department, in conjunction with provincial authorities, is working on noise problems associated with railway yards.

My Department does not have any direct jurisdiction over community noise. However, since high levels of sound can be of health concern we take a close interest in all situations requiring noise abatement for health protection. Officials of my Department are represented on a Federal-Provincial Committee on Noise and the situation at the CPR marshalling yards will be brought to the attention of that Committee at an early date.

Thank you for bringing this to my attention.

Yours truly,

Marc Lalonde

Ottawa K1A 0A6
September 11, 1975

Mr. Joe DeKort
64 Blueberry Drive
Agincourt, Ontario

Dear Joe:

In Mr. O'Connell's absence I thought I would send you a copy of a letter which he recently received from E. J. Benson, President of the Canadian Transport Commission. This relates to his letter of July 17 concerning the train noise problem in the vicinity of the Halvern and Whitehaven communities.

I'll bring this letter to Mr. O'Connell's attention upon his return to the office, and we will certainly keep following up on it. Let us know if any further assistance is required in this or any other matter.

Best regards,

Nicole Bourgeois
Executive Assistant



Canadian TRANSPORT
Commission

Commission canadienne
des TRANSPORTS

OTTAWA, Ontario

K1A 0N9

August 21, 1975

Mr. Martin O'Connell, M.P.,
House of Commons,
Ottawa, Ontario.

Dear Mr. O'Connell:

Thank you for your letter dated July 17th, concerning the train noise problem in the vicinity of CP Rail's marshalling yard near the Malvern and Whitehaven communities in Scarborough.

Subsequent to your conversation with Mr. Green of our Railway Transport Committee's Operations Branch, a Transportation Officer met with Mr. Joe DeKort, Alderman of Ward 12, as you suggested. Our Officer spent some three hours on the evening of July 16th touring the problem area with Mr. DeKort. A few days later this Officer met with Railway Officers and toured the Railway's yard facilities.

The Committee has requested that the Railway file a submission on the matter of train noises, what remedial action they have undertaken or what they foresee can be done to abate the nuisance train noises emanating from their yard facilities at Agincourt.

For your information I am enclosing a copy of Minutes of a meeting between representatives of the Railway and members of the Subcommittee of the Building, Fire and Legislation Committee of the Borough of Scarborough, which took place on June 17th, 1975.

Also enclosed is a copy of a recommendation which was embodied in a report of the Scarborough Committee to its Council.

Whenever I am in receipt of any further information or developments in this matter, I will be in further communication with you.

Yours very truly,

E.J. Benson,
President.

MEMORANDUM

On June 17, 1975, attended meeting in Scarborough Town Centre at 2000 to discuss noise problems caused by operations of CP Rail hump yard at Agincourt.

Alderman Ronald Watson chaired the meeting. CP Rail representatives were:

- A. A. Boyar, Superintendent, Toronto
- S. Weightman, Director of Market Development, Toronto
- M.S. Andrews, Assistant Superintendent, Toronto
- S.M. Barluk, Assistant Superintendent, Toronto
- H. J. Frechette, Terminal Production Supervisor, Toronto

Mr. Watson explained that the problem was that the marshalling yard was in the midst of new communities either under development or now developed and the residents were concerned about the noise factors.

The nature of the problem was defined as:

1. Humping activities in late hours of evening and early morning disturbs the resident. The noises heard are those of the retardation of cars and cars coupling together.
2. Noise of air whistle when it is blown to alert workers that humping activities are about to commence.
3. The smell of diesel fumes.
4. The noise is very intense and people find it unbearable. Prevailing winds carry the noises and fumes.

The solutions, as the Borough Aldermen see them, were in the following questions:

1. Can night activities be decreased?
2. Is there any way to control braking?
3. Can there be cushion bumpers on cars?
4. Could the retarder be enclosed so that squealing would be confined?
5. Is there any plan for the hump to be moved in the future?
6. Could the hump operation be relocated to another portion of the Yard?

Mr. Boyar responded by saying that the marshalling yard is an intransit yard which is designed to operate 24 hours per day and so there was no way our activities would decrease. The braking noise from the retarder was difficult to overcome as well as the noise made by cars coming together as this was contact of metal on metal and the noise factors were there. Enclosing the hump has not been looked at very seriously. It was a surprise to learn that the air whistle being sounded when humping commenced bothered the residents but as a safety measure it was very important that the whistle be sounded. The use of page boys as an alternative could not be considered due to the fact that they are prone to malfunctions. The slack action is noisy due to this being the striking of steel against steel and there was very little that could be done.

Mr. Weightman pointed out to the Eorough that land developers are made aware of the noise factors around railway marshalling yards and we stress that buyers should be made aware of the situation. He mentioned that the Department of Housing approves land developments near railway locations on the condition that the buyer is notified by the developers of the existing rail line facilities.

The Eorough representatives said that they would have to look at the official plan for all areas near the yard..

One of the Aldermen said we should look at enclosing the retarder area and it was pointed out that our supervisors would no longer be able to see car movements and this would make our operations unsafe. The area is well lit at night and so visual observance of cars passing through the retarders is possible and important at all times.

We were asked to look at landscaping the perimeter of the yard. It was made known that the planned population could be doubled in a short time. The development at Malvern will creep westward and more complaints will be generated.

Mr. Boyar said that it would be impossible to consider enclosing the total area of the yard.

Mr. Roger Brown, Planning Engineer, explained that there had been mixed results with the use of buffer zones. The real problem, he said, was one of mixed land use i.e. marshalling yard, housing and industrial. It was unfortunate that industrial land had been used for housing. The advent of commuter traffic would probably mean more problems. He thought noise from vibrations was a real problem but he had no real solution. The Eorough is committed so it must go ahead with Malvern.

There is an ever increasing pressure for the Eorough to increase the density of developed areas and provide more housing. The marshalling yard is taxed about \$154,000. per year and removing it is out of the question as it makes a large contribution to the Eorough in tax dollars and in providing jobs as well as serving industries in the area.

CP Rail was asked if anything was being done to reduce the noise factors and it was said that ribbon rail was now in use and this reduced the noise made by moving trains.

Mr. Boyar stated that CP Rail has many experienced engineers and possibly we could cooperate in a study to try and arrive at a workable solution to the noise problem. The Eorough drafted up a motion to be referred to the Board of Control and then expressed their thanks for such a good representation attending the meeting.

The meeting closed about 2130.

TERMINAL PRODUCTION SUPERVISOR

Clerk's Department

Recommendation embodied in Report No. 13 of the Building, Fire & Legislation
as amended Committee
adopted by Council at its meeting held on July 14, 1975

2. Noise and Diesel Exhaust from the Agincourt Marshalling Yard

Committee received the following extract of the Minutes of Meeting of the Sub Committee of the Building, Fire and Legislation Committee held on June 17, 1975, viz:

"Committee discussed this matter in detail with the following people who were invited to attend this meeting:

Mr. A.A. Boyar, Superintendent, Toronto Division, C.P. Rail.
Mr. S.M. Barluk, Assistant Superintendent, Toronto Division, C.P. Rail.
Mr. M.S. Andrews, Assistant Superintendent, Toronto Division, C.P. Rail.
Mr. H.J. Frechette, Terminal Production Supervisor, Toronto Division, C. P. Rail.
Mr. Stan Weightman, Director of Industrial Development, C.P. Rail.
Mr. Larry Kent, Executive Assistant, The Hon. T.L. Wells.
Mr. P.H. Allen, C.D. Farquharson Community Association.
Mr. B. Madden, Malvern Residences Association.

The Committee agreed to recommend to Council that C.P. Rail be requested to consider the feasibility of undertaking a study of the Agincourt Marshalling Yard district addressing the following problems:

- high-pitched car retarder noise
- slack take-up noise
- hump locomotive noise
- night use of high powered locomotive horns
- diesel exhaust fumes

The study to also consider the feasibility of enclosing the humping facility in the yard, and that consideration be given to the possibility of rescheduling the night activity in the yard to the week-day hours.

Committee further agreed that the Planning and Works Departments consider the matter of providing an effective buffer for the neighbourhoods to be developed in the area of the Marshalling Yard.

Committee expressed its appreciation for the representation from C.P. Rail and thanked them for having taken the time to discuss this matter with the Committee and the area residents."

COMMITTEE RECOMMENDS adoption of the foregoing recommendation of the Sub Committee.

THE FOREGOING CLAUSE WAS AMENDED BY ADDING THE FOLLOWING TO THE RECOMMENDATION:

That the Canadian Transport Commission be also advised of this recommendation.

Ottawa KIA 046
July 17, 1975

Mr. Joe DeKort
64 Blueberry Drive
Agiacourt, Ontario

Dear Joe:

I attach copies of some correspondence I have initiated as a result of our meeting on Saturday in your home re the noise levels at the CPR marshalling yards. One letter is to the CTC; another is to Marc Lalonde re noise levels.

It may take me a few days to get some action going here, but I want to see the lie of the land before doing anything in the House of Commons. I attach also a photostat of a certain page in the Railway Act so that you will have some idea of one place of entry for the Commissioners. I'm not too hopeful about them, but at least we will have to put some heat under them and see how far we can get.

Incidentally, I called Chief Ackroyd and wrote him today. He wanted to discuss the matter with Chief Adamson before deciding whether David Penny should or should not be approved for the Citizens Advisory Group for the L.I.P. projects. I will hope to hear back this week.

It was a great day at your house. I really want to get into local problems where there is a federal aspect to them. Please don't hesitate to lean on me a bit from time to time because you will know where the shoe is pinching more than I do. It certainly is great to be associated with a new and growing community. It gives a lot of meaning to our role as public representatives. All best wishes.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East



OFFICE OF
THE MINISTER OF NATIONAL HEALTH AND WELFARE
AND
MINISTER RESPONSIBLE FOR THE STATUS OF WOMEN

CABINET DU MINISTRE DE LA
SANTÉ NATIONALE ET DU BIEN-ÊTRE SOCIAL
ET
MINISTRE CHARGÉ DE LA SITUATION DE LA FEMME

OTTAWA, K1A 0K9
AUG 5 1975

The Honourable Martin O'Connell, P.C., M.P.,
House of Commons,
OTTAWA, Ontario.
K1A 0A6

Dear Mr. O'Connell:

On behalf of the Minister, the Honourable Marc Lalonde, I wish to acknowledge receipt of your letter of July 17, 1975, concerning the noise problem from the CPR marshalling yards in Scarborough, Ontario.

I have asked officials of this Department for information on this matter, and as soon as this is received, Mr. Lalonde will be in touch with you.

Yours sincerely,

Ann C. Jamieson
Executive Assistant

Ottawa KIA 0A6
July 17, 1975

Honourable E. J. Benson, President
Canadian Transport Commission
Congill Building
275 Slater Street
Ottawa KIA 0M9

Dear Mr. Benson:

This is just to let you know that I have been talking to Mr. J. R. Green of the Operating Branch at the C.T.C. concerning a serious noise problem at the CPR marshalling yards near McCowan and Sheppard Avenues in Scarborough.

This summer, seemingly more than ever before, the noise emitted by the turbochargers of the diesel locomotives as they push cars up the hump in order to have them roll down the other side is so continuous and of such a piercing and high-pitched character that residents are quite upset. Their doors and windows are open at night and they find it hard to sleep. The noise appears to go on 24 hours a day. There is also the squealing noise of metal on metal as the retarders operate to slow the cars down as they come down the hump into the various new formations as new trains are made up.

I know that the railways do not stand only on the ground that, "we were here first". I know that they have tried to cope with some similar problems in Edmonton and probably at the CNR yards in Maple, but I suspect it will take a good deal of pressure to oblige them to overcome this particular difficulty. They may, in fact, have been there prior to the building of the Whitehaven community but I somehow doubt it. They certainly were there before the building of the new Malvern community. Both are severely affected by the noise. I stayed in the area for two hours on Saturday past and heard the whistle many, many times. One gets to wait for the next high, piercing sound. I was approximately one mile from the hump yards.

Honourable E. J. Denson

2

July 17, 1975

The Malvern Community, as you know, is a federal-provincial land assembly plan and is a planned community with residential development now coming closer and closer to the marshalling yards. Something obviously must be done to protect the community against the noise levels which, I believe, are over and above what would normally be expected in a marshalling yards. It simply no longer meets general community standards, and I hope that your officials will be able to persuade the Railways to do something effective about it.

Mr. Green indicated he would be in touch with his people in Toronto and that they would contact the Ward 12 Alderman, Mr. Joe DeKort, and would inspect the property and try to assess the problem. This was just to keep you posted. Incidentally, I think I will write the Honourable Marc Lalonde, Federal Minister of Health and Welfare, to see whether the Federal Government has any control over noise levels where there is a federal jurisdiction.

With all best wishes.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East

Ottawa K1A 0A6
July 17, 1975

Mr. J. H. Green
Assistant Director
Operating Branch
Railway Transport Committee
Congill Building
275 Slater Street
Ottawa K1A 0N5

Dear Mr. Green:

I appreciated the opportunity to speak with you yesterday afternoon concerning the noise problems faced by the Whitby and Halvern communities in Scarborough as a result of certain operations at the CPR marshalling yards in the Scarborough area approximately at McCowan and Sheppard Avenues.

There is a very high-pitched whistle either originating from a warning whistle on locomotives or from the whistles emitted by turbochargers of the diesel locomotives which push cars up the hump in the marshalling yard. This whistle goes on 24 hours a day. It is, of course, intermittent; but it is so high and penetrating that people now await the next whistle. They find it difficult to sleep at night. Naturally, during the summer hours when windows and doors are open, the whistle is more objectionable than ever. There is, in addition to this, the squeaking of metal on metal as a result of the action of the retarders where the cars are slowed down before they couple. There is also the noise of the coupling itself. All in all, this summer appears to be the worst and I have received a number of complaints as has the Alderman for Ward 12, Mr. Joe DeKort.

Mr. J. H. Green

2

July 17, 1975

You stated that you would be in touch with Toronto officials and that they would inspect the operation to identify the source of the problem and to assess its intensity. I gave you the name of Mr. Joe DeKort, 64 Blueberry Drive, Agincourt (293-8022); his office address is 152 Borough Drive, Scarborough M1P 4J7 (433-7275).

I trust that something can be done to eliminate or moderate considerably the noise levels at these yards. You pointed out that some progress had been made in Edmonton in this respect. I think Mr. DeKort plans to introduce the problem to the Borough Council very soon and possibly to try to arrange a meeting with the Railway authorities. Whatever is done, it is clear to me that some action will have to be taken to lower the impact on the community of the noise levels as they currently exist.

Many thanks for your cooperation.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East

Ottawa KIA 646
July 17, 1975

The Honourable Marc Lalonde
Minister of Health and Welfare
House of Commons
Ottawa

Dear Mr. Minister:

Re: CPR Marshalling Yards
and Noise Levels

I attach a copy of a letter I have just written to the Honourable, E. J. Benson, President of the Canadian Transport Commission, explaining to him the noise problem that has arisen in Scarborough as the result of the operation of the CPR marshalling yards.

You will note from the attached letter that there is a very high and penetrating whistling sound as the diesel locomotives push cars up a hump so that they will run down the other side by gravity and form new trains as a result of the marshalling operations. The high sound is either a warning whistle on the part of the locomotives to those who are down below or is the high whining sound of turbochargers as they idle as part of the whole exercise. This goes on 24 hours a day depending on the business. It keeps people awake at night. It is particularly bad in the summer when windows and doors are open, but it is bad all year round. I observed the whistle very clearly one mile from the marshalling yards and undoubtedly it penetrates for approximately two miles. It is beyond endurance. People wait for the next whistle which perhaps is only three or four minutes away in time. There is also the high squealing sound of metal on metal as the retarders go into action to slow the downhill movement of the cars in order to reduce their speed for coupling purposes. These two noises are beyond community standards.

July 17, 1975

The purpose of my letter to you is to ask whether you have any jurisdiction over federal enterprises with respect to noise levels. I know that there is some federal-provincial discussion of noise abatement, and I suspect that even though it is a local problem, there may be a federal jurisdiction in the case of the Railways. I have looked through the Railway Act and I find that Section 227 (1)(b)(d) may have some relevance to the use of whistles and the coupling of railway cars. They probably have more relevance from the viewpoint of safety than from the viewpoint of noise.

I would very much appreciate you letting me know whether you feel you have a jurisdiction in this field with respect to decibels or any other measurement of noise and its abatement. I intend to follow this matter up in some fashion to protect the community from the current noise levels. It should either be done through the CTC or through your Department or in fact through both. Anything you could do to advise me would be very much appreciated.

Yours sincerely,

Martin O'Connell, M.P.
Scarborough East

APPENDIX I

(Draft for Alberta Noise Report)

3. RAIL TRANSPORT

The Canadian railway network provides a vital link to Canadian trade and economy. Canadian National Railways and Canadian Pacific Railways span Canada from the Atlantic to the Pacific, a distance of some 4,000 miles. In addition there are several provincial railways such as Ontario Northland. The total length of track is over 60,000 miles. The shipment of freight across Canada represents a large portion of railway operations. Two hundred and fifty million tons of freight are transported annually on the railways in Canada. A growing portion of this freight is handled by the container method of shipment and more recently the "piggyback" system whereby loaded trailers are carried on specially designed rail cars. Freight carried by the railways in container form amounts to about three million tons on some 140,000 special cars. Typical long distance freight trains are a mile long and hauled by three or four 3,000 horsepower diesel locomotives.

Passenger carrying facilities are also provided. These range from trans-continental passenger trains through high speed Turbo trains to local commuter carrying facilities. Over 20 million passengers are transported annually.

The total revenue to both major railway operators from freight and passenger services amounts to some two thousand million dollars annually.⁽¹⁾ As might be expected, this vast inter-provincial railway network is under the jurisdiction of the Federal Government and has been since The British North America Act of 1867.

Clearly the railways are the lifeblood of Canadian trade and economy, but it is estimated that about half a million Canadians⁽²⁾ live in areas where noise from railway operations is excessive. It seems likely that these Canadians are adversely affected by this nationwide facility in terms of sleep, activity and speech interference as well as decreased property values.

3.1 Railway Noise Sources

The sources of noise from railways can be divided into broad categories - those connected with pass-bys and those associated with other operations such as switching, marshalling and freight train classification.

3.1.1. Railway Pass-by Noise

A large proportion of pass-by noise sources are associated with the locomotive itself. Typical power developed by a locomotive is of the order of 3,000 h.p. Apart from noise issuing from the engine casing itself the dominant noise source is the exhaust stack situated some 15 ft. above track level. The exhaust gases after being used for turbocharging, are in most cases vented, through spark-arresters but otherwise unmuffled, directly to the atmosphere. As would be expected the ensuing sound levels are high, ranging from around 84 dBA for an idling locomotive to 98 dBA for a locomotive at high speed (both sound levels at 50 ft.) according to a train noise model derived by the Ontario Ministry of the Environment.⁽³⁾

Associated with the locomotive are bells and whistles which are rung or sounded approaching railway crossings. The National Research Council (Ottawa) in a Draft Central Mortgage and Housing document⁽⁴⁾ used the Ontario train noise model⁽³⁾ and added their own model for whistle noise based on an instantaneous level of 110 dBA at 50 ft.

Fortunately the high locomotive sound levels are relatively short lived during a typical train pass-by. The noise associated with the wheel-rail interaction can last considerably longer for a lengthy freight train. The wheel-rail noise is produced primarily by wheels passing over joints between adjacent rails and sustained by "ringing" of the steel wheels.

Typical wheel-rail interaction sound levels at 50 ft. range from 68 dBA at low speeds to 91 dBA at high speeds.

3.1.2. Other Railway Noise Sources

Under this heading the dominant railway noise sources are associated with classification yards where freight trains are made up and with other switching and marshalling functions. In the classification yards, individual cars are pushed over a "hump" and travel downhill to the various tracks where trains are being made up. In order to avoid collisions between these cars and stationary cars already classified, a computer controlled retarder is used. This retarder is composed of beams which clamp either side of the car wheels and hence slow the car down. An extremely unpleasant product of these retarders is a very loud (120 dB at 100 ft) "squeal" from the retarder which is rendered more annoying by its tonal content⁽⁵⁾. Not all cars produce this squeal when being retarded, it being restricted possibly to the heavier cars⁽⁵⁾. Because of the high instantaneous levels and the annoying tonal content, retarded noise can have an effect over a wide area. A further noise source in marshalling operations is that of repeat impacts between the couplings of adjacent cars. Such impacts occur when a train is (carelessly) accelerated or decelerated, a series of high instantaneous sound level - 90 dBA at 125 ft.⁽⁶⁾ - impacts being produced as each car contacts the next. In common with other impulsive sounds from shunting, impacts have the additional adverse effect of startle upon the listener.

3.2 The Measurement and Assessment of Railway Noise

Railway noise measurements are usually required in two situations, first when a locomotive or rolling stock is to be assessed as a source of noise and secondly when a railway facility (classification yard, repair shed or even a simple set of tracks) is to be assessed for its impact on nearby existing or planned residences.

3.2.1. Noise Measurement of Locomotives and Rolling Stock

In 1975, the I.S.O. published a standard for the measurement of noise emitted by railbound vehicles⁽⁷⁾. Basically the standard recommends the measurement of A-weighted sound levels at a distance of 7.5 m (25 ft.) from the railway tracks, with the vehicle running at certain representative speeds. A test site is also advised for stationary vehicles. The United States Environmental Protection Agency has also published a measurement technique, with associated maximum permitted levels in its railroad noise emission standard⁽⁸⁾. Again standard procedures are recommended for both stationary and moving vehicles of A-weighted decibels at a distance of 100 ft. The standards set in this document are tabulated below:

Manufacturer Completion Date	Stationary Locomotives	Moving Locomotives
Before Dec.31/79	93 dBA (73 dBA at idle)	96 dBA
After Dec.31/79	87 dBA (70 dBA at idle)	90 dBA

Maximum Sound Levels for Locomotives⁽⁸⁾ (dBA Fast at 100 ft)

The EPA standard and others are at present under examination by the Railway Noise Working Group of the Canadian Standards Association, Noise and Acoustics Committee.

3.2.2. Assessment of the Impact of Railway Noise on New Residential Subdivisions

No formal standards or guidelines exist for the measurement of noise levels due to railway operations. However work has been performed on sociological surveys into the effects of train noise⁽⁹⁾⁽¹⁰⁾.

Both of the reports concluded that the energy equivalent level (L_{eq}) in A-weighted decibels, dBA is a good descriptor for the assessment of train noise annoyance. Following this work and other international standards recommending noise levels for new residential subdivisions, the Province of Ontario⁽¹¹⁾ uses the following outdoor sound level limits for train noise.

	Day (07:00 to 23:00)	Night (23:00 to 07:00)
L_{eq} (dBA)	55	50

Sound Level Limits for New Residential Development in Ontario⁽¹¹⁾

If these limits are used then the measurement procedure is fairly well defined. A full 24 hour sound level monitoring is required, necessitating a community noise monitor which can be left unattended. The monitor position should ideally be on the site of the proposed (or existing) development where the levels would apply.

3.3. Locomotive noise

Several noise sources can be considered here - locomotive noise, wheel-rail interaction noise, retarder noise and finally shunting impact noise.

3.3.1. Locomotive Noise

Despite the high power levels produced by railway locomotives, possibilities do exist for noise reduction. Exhaust muffling is a distinct possibility. Very few locomotives appear to operate with mufflers and as is well known from truck noise control, significant noise reduction can be obtained. Clearly the muffler would have to handle large gas flow rates at elevated temperatures, and would perhaps be restricted in size and shape due to the location of the exhaust on the top of the locomotive.

Other possibilities for noise reduction once the exhaust noise had been decreased would be both vibration damping and sound absorptive materials placed on the inside surfaces of the engine enclosure.

At present the enclosure is in the form of relatively light steel doors with ventilations louvres. These doors could well vibrate and produce undue noise. The radiators and fans used on some locomotives are large. Fan tip speeds and design could well be carefully investigated and efficiency as well as noise levels improved. The noise of the associated locomotive equipment not necessarily connected with power production could also be attenuated. Locomotive whistles for instance produce extremely high sound levels. Whistle blowing is commenced one quarter of a mile from railway crossings and yet can be clearly heard many miles away. It may be possible to lower the sound levels of whistles and yet maintain a safe warning system.

3.3.2 Wheel-Rail Interaction Noise

As the wheel-rail interaction noise is mainly produced by wheels passing over joints, it seems reasonable that noise reduction could be obtained by reducing the number of joints. This has in fact been done using "welded-rail" in which some 5 or so regular sections of rail are welded together. Joints still remain between these longer sections but sound level reduction between 3 and 5 dBA have been achieved. Some main line heavily travelled tracks in Canada have been converted to welded-rail. A further reduction in sound level could be achieved by using damping materials to stop car wheels "ringing" after passing over a joint. Although effective, the cost of applying such materials to the hundreds of thousands of rail cars in Canada would be considerable if not prohibitive.

Wheel-rail interaction noise can also be excited by "flats" or flat portions of car wheels. Although careful maintenance of both wheels and rails is desirable, only few car wheels suffer from flats and hence the reduction of noise would be limited to relatively few cars.

3.3.3. Retarder and Shunting Impact Noise

Despite a thorough practical and theoretical examination of retarder noise⁽⁵⁾ only slight sound level reductions were obtained without destroying the efficiency of the retarder. As not all cars passing over the retarder produce the tonal "squeal" (not necessarily depending on the weight of the car) it is felt that perhaps the mechanism producing the noise is not fully understood. An explanation of why some cars squeal and others do not may lead to an effective method of ensuring that no cars produce a squeal as they pass over the retarders. Shunting impact noises, like several other railway noises are the result of steel on steel contact. Use of other materials could lead to some decrease in sound levels although it appears that if reasonable care is taken accelerating, or decelerating, trains then these impacts can largely be avoided. Perhaps a combination of better design of couplings and more carefully controlled shunting procedures could result in lower shunting impact sound levels.

3.3.4. Administrative Controls

Mention of the control of shunting methods leads to a consideration of other administrative means of reducing the effect of railway noise on surrounding residential districts. The most powerful means of doing this is to minimize night time operations. The evening and night hours are crucial for relaxation and sleep and as such are sensitive to noise intrusions. Wherever possible night time operations should be reduced to allow more peace and quiet during these hours.

A further method would be to avoid using tracks close to residences wherever possible and place greater use on yards close to industrial or commercial operations. Speed limits could have some effect on sound levels for the reason that both locomotive and wheel-rail interaction noise increase with speed. In marshalling yards older disused rolling stock should be placed on the tracks closest to residences to act as a partial screen. Locomotives idling should be kept to a minimum and whenever locomotives must idle they should be placed away from residential areas.

In summary such administrative controls individually may not have a very great effect, but taken cumulatively could lessen the adverse effects of railway noise on residential areas. Noise should become a significant factor in planning railway operations.

3.4 Reduction of the Effects of Railway Noise

This section is devoted to railway noise reduction not at the source but along the propagation path of the sound and the receiver position. As such the methods suggested assume the existence of a problem at the source, however some of the measures outlined could be used by the railways within their own property.

3.4.1. Land Use Planning

Many of the adverse effects can be avoided, where planning flexibility exists, by placing noise insensitive land uses (industrial or commercial for example) between railway tracks or yards and residential development to act as a noise buffer and also to provide distance as a noise control measure. Such land use planning with respect to noise should be carefully and rigorously implemented by both the Municipal and Provincial levels of government and also supported by the Railways themselves. This approach would avoid the addition of new complainants to those already in existence.

3.4.2 Barrier Structures

If little planning flexibility exists and a site is designated for residential development, noise control measures can still be designed into the site. Some form of barrier could provide a useful reduction in outdoor sound levels due to trains. A simple barrier (berm, solid wood fence or combination) could be used to provide a limited amount of attenuation. If more attenuation is required then row townhousing is a powerful tool. Indoor sound levels in the townhouses themselves can be reduced to acceptable levels using

suitable glazing (see below). Outdoor areas associated with the townhouses are then placed on the acoustically shaded side of the townhouses, the family automobile being left in the noisier areas on the exposed side of the townhouses. If correctly designed such a townhouse row could even protect second storey windows in the residences it shields. Noise control measures such as those are regularly recommended as part of the subdivision circulation and approval process in Ontario and are similarly recommended in the CMHC Guide produced by NRC⁽⁴⁾.

3.4.3. Use of Acoustical Insulation

In cases where control of the outdoor environment is not considered necessary (for instance at night when the prime consideration is sleep interference, a predominantly indoor activity) then indoor noise levels can be lowered by using suitable acoustical materials in the design of the building facade. As normal building construction produces exterior walls with fairly high sound transmission loss, such special design reduces primarily to consideration of windows and doors. The use of suitable double glazing and solid core and/or storm doors can lead to acceptable indoor sound levels even when outdoor noise levels are considered a serious problem. Design data for windows, doors and walls are contained in readily usable form in the CMHC Guide produced by NRC.⁽¹⁴⁾

3.5 Vibration Problems due to Railways

Little information is available on the problems associated with vibration due to Railway operations, although the Ontario Ministry of the Environment has started to investigate this area⁽¹⁵⁾. As yet no vibration level limits for railway vibrations exist in Canada. The problem is not a simple one and can take several different forms. At worst vibration can cause structural damage and at lower levels even when below the thresholds of human perception, could cause easily perceived noise. This can be particularly true in the case of rattling dishes and windows.

If vibration limits were set for new residential developments then it appears that continuous strip neoprene could be used as vibration isolation down to low enough frequencies. Clearly more work needs to be done in these areas before limits are guidelines on vibration levels and necessary isolation can be formulated.

3.6 Future Efforts and Research to Reduce Train Noise

This chapter has attempted to present in general and in straight forward terms where the main problems lie with respect to train noise and what possible solutions exist. The solutions presented are definitely not exhaustive and further, some may be of much greater use than others. This final section is an attempt at setting a broad agenda and areas of possible responsibility and effort for furthering these suggested solutions.

Taking initially the various levels of government, the Federal Government as it has the interprovincial railways under its jurisdiction is the only body who can bring pressure to bear on the railways to reduce their sound levels. This could be done either by setting limits on new equipment (more restrictive than those in 3.2.1.) or by proposing the introduction of administrative controls. Whatever the involvement of Provincial Governments with regard to railway noise levels, they can only follow the lead of the Federal Government and their published Guidelines or even Legislation.

Provincial levels of government has the responsibility of furthering sensible land use planning around railway facilities but could also provide support to the Federal Government in the form of local expertise, provision of instrumentation and manpower support as available, support at meetings and input to policy decisions. Those provinces with their own railway operations could also help matters by introducing as many noise control measures and procedures as possible.

At the Municipal level, zoning should take account of noise problems surrounding railway facilities. Initially land in the vicinity of railroad operations could be zoned industrial and commercial, forcing rezoning applications wherever a demand or desire existed for residential development.

Turning to other bodies involved, the railways themselves should carefully consider administrative controls, using their own Research and Development organizations for this and other investigations. At present the railways are aware of noise problems and in many cases have good relations with local governments, providing information and support wherever possible on land matters. This input should be increased with a view to examining their own operations with a view to reducing noise levels. Areas of detailed expertise could well be provided by the Universities, research being supported financially by railways and possibly government. The Universities represent a significant research force in Canada and many have the expertise and necessary facilities in the acoustical field. Such expertise should be used to the full in the future investigations of the railway noise.

To summarize, all the organizations mentioned here should co-operate to investigate and enforce solutions to the railway noise problems in Canada and provide relief to those half million Canadians obliged to suffer railway noise.

REFERENCES

1. Canada '75: Information Division, Statistics Canada. December 1974
2. The Canadian Railway Noise Problem, Background Data: Department of Fisheries and the Environment. February 1977.
3. Development of a Model for Predicting Train Pass-By Noise Profiles: J.R. Hemingway, Ontario Ministry of the Environment, Acoustics and Noise Control in Canada p. 21 Vol. 4 No. 4. October 1976.
4. New Housing and Road and Rail Noise (Draft 2) Professional Standards and Services Group, Central Mortgage and Housing Corporation, Ottawa. August 1976.
5. An Investigation of Railroad Car Retarder Squeal: M.G. Faulkner and A. Mioduchowski, University of Alberta, Acoustics and Noise Control in Canada p. 34 Vol. 4 No. 4. October 1976.
6. Characterization and Control of Railroad Noise: E.K. Bender et al. Bolt Beranek & Newman Inc., p. 241 Inter Noise '74 Proceedings. September 1974.
7. Measurement of Noise Emitted by Railbound Vehicles: International Standards Organization Ref. ISO 3095-1975(E). September 1975.
8. Railroad Noise Emission Standard: USEPA Federal Register Vol. 41 No. 9, Title 40, Chapter 1, Part 201. January 1976.
9. The Assessment of Annoyance Due to Train Noise: J.R. Hemingway, Ontario Ministry of the Environment, Acoustics and Noise Control in Canada p. 31 Vol. 4 No. 4. October 1976.
10. Development of an Acoustic Rating Scale for Assessing Annoyance Caused by Wheel/Rail Noise in Urban Transit: T.J. Schultz, Transportation Systems Centre USDOT, NTIS Report No. UMTA-MA-06-0025-75-2. February 1974.
11. Guidelines for Noise Control in Land Use Planning: NPC 131, Model Municipal Noise Control By-Law, Revised 1976, Ontario Ministry of the Environment. May 1976.

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